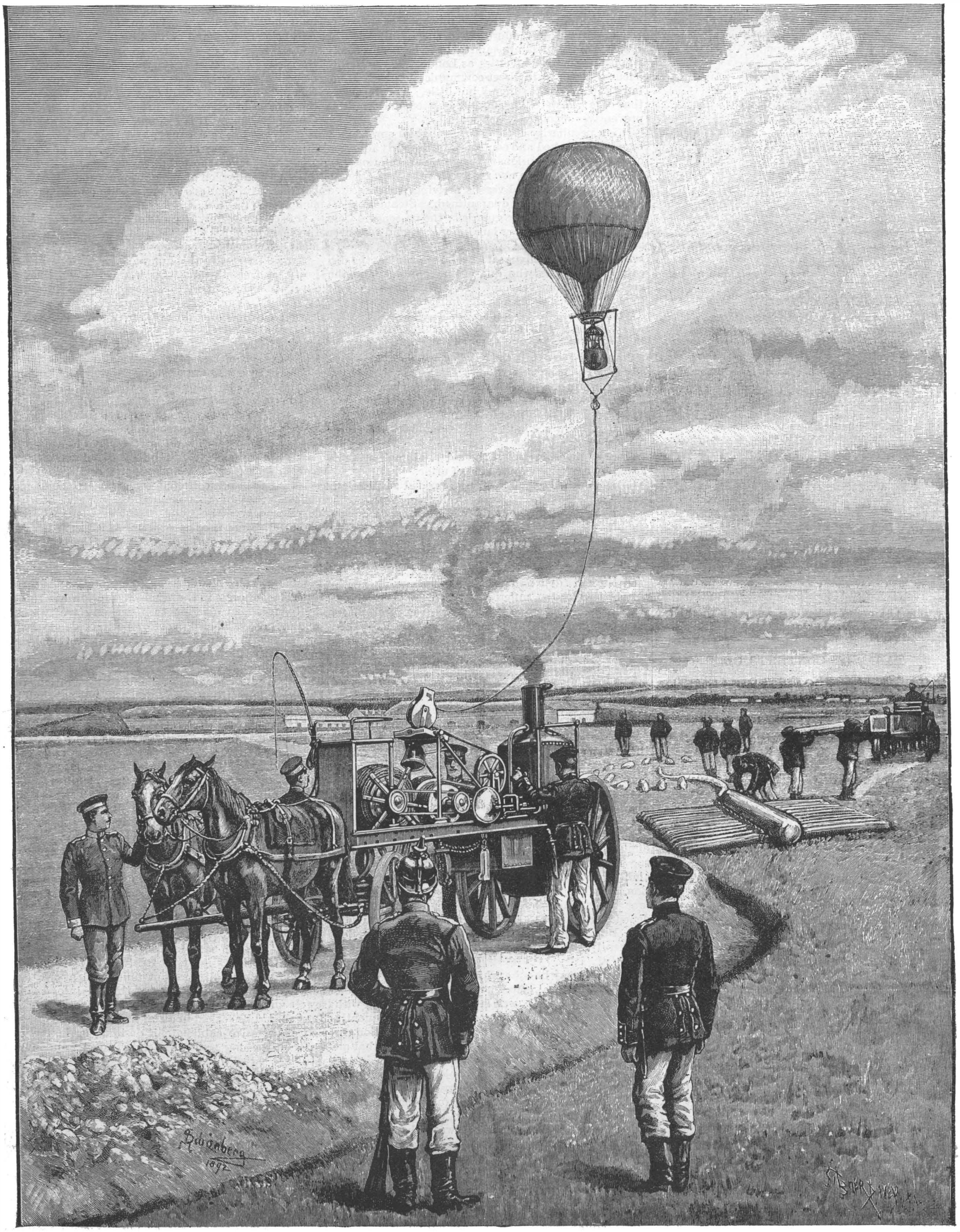
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyrighted, 1892, by Munn & Co.

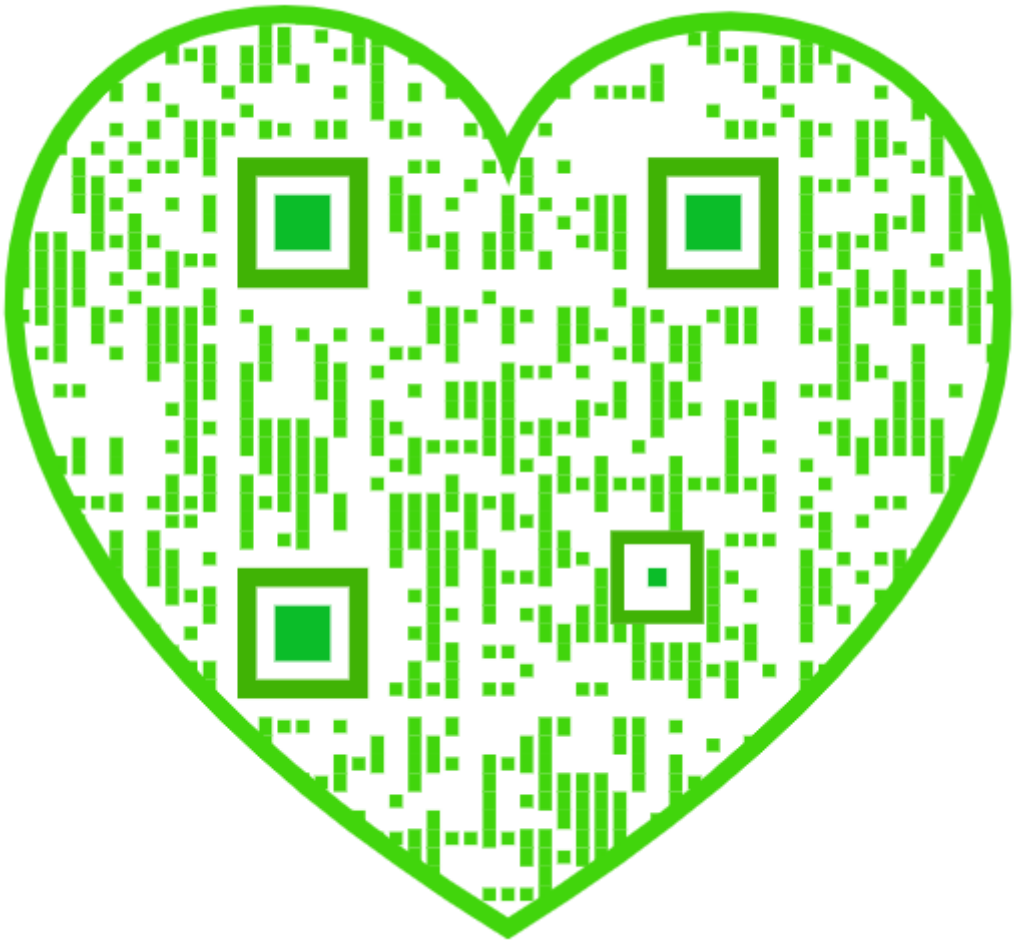
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXVII.—No. 14. ESTABLISHED 1845. NEW YORK, OCTOBER 1, 1892. $3.00 A YEAR. WEEKLY.



GERMAN MILITARY BALLOON APPARATUS.—[See page 213.]

© 1892 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *nine dollars a year*.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, $5.00 a year; combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign countries, $11.50 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, OCTOBER 1, 1892.

Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural inventions, recent.. 218
Antimony, electrolytic process for..... 217
Baku, town and harbor of*..... 210
Balloon apparatus. German military*..... 207
Beer seed, California..... 217
Bitumen oil and gas in France.... 210
Books and publications, new.... 218
Cable plant, Washington, D. C.. 217
Canal convention, N. Y. State... 215
Cholera and its management.... 208
Cholera, progress of..... 208
Croton trees..... 211
Edison's New Jersey village..... 211
Electrical transmission, long distance..... 214
Electric cars in Boston..... 216
Electric plant for Rome, Italy*.. 214
Fabric, a novel..... 213
Famine and disease in Russia... 210
Geological ideas, novel..... 209
Glycerine in wine..... 215
Handles, hard wood, preservation of..... 216
India rubber goods, preservation of..... 212
Inventions, recently patented... 218
Lemonade, laxative..... 215
Mathematical instrument, new.. 211
Mechanical devices, recent..... 218
Notes and queries..... 219
Nut lock, Schanweker's*..... 211
Optical theater, Reynaud's..... 215
Patents granted, weekly record.. 219
Petroleum center, Russian*..... 210
Photography, cobalt toning..... 216
Photography, high speed..... 216
Pipa Americana, the*..... 217
Planets, the, in October..... 212
Powder, new smokeless, apyrite. 216
Railway appliances, some new... 218
Snow sheds burned..... 209
Soda foam..... 213
Sound..... 212
Speed indicator, the Weiss*..... 211
Typewriter, English's*..... 211
Water power electric plant, a large*..... 214
Young Men's Institute, N. Y..... 213

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 874.

For the Week Ending October 1, 1892.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ARCHÆOLOGY.—New Discoveries at Pompeii.—Interesting remains just discovered at Pompeii, including two human cadavers.—3 illustrations..... 13959

II. BIOGRAPHY.—Pliny Earle, A.M., M.D.—A distinguished alienist, recently deceased.—His life work and his views concerning the treatment of the insane.—1 illustration..... 13970

III. CIVIL ENGINEERING.—New Method for Foundations.—A recently patented method of producing foundations in quicksand by operating from the surface through pipes.—11 illustrations..... 13962

IV. ELECTRICITY.—Human Electricity.—The electricity of the human system.—Analogies derived from experiments with animals.—An interesting contribution to electro-physiology..... 13968
The Magnetic Curve Tracer.—A combined magnetometer and galvanometer for tracing the curve of magnetization of different samples of iron.—1 illustration..... 13969

V. FINE ART.—Florentine Pietra Dura or Mosaic Work.—An interesting review of the famous Florentine mosaic manufacture.—How the work is done, with numerous statistics..... 13961

VI. MECHANICAL ENGINEERING.—Lathe for Rose Turning.—A lathe for executing ornamental work of the most varied description, both oval and circular, with examples of the work produced.—3 illustrations..... 13964

VII. NAVAL ENGINEERING.—Life-Saving Devices.—A continuation of the interesting series of suggestions for saving life at shipwrecks.—3 illustrations..... 13965

VIII. PHARMACY.—Explosive Substances.—By CHARLES D. LIPPINCOTT.—A long list of substances which may be encountered by the pharmacist, and which are liable to produce explosions, with examples of dangerously explosive prescriptions..... 13973

IX. POLITICAL ECONOMY.—The Development of Capital at Rome.—By Lawrence A. Hemphill, Ph.M.—An exhaustive synopsis of the political finances of ancient Rome, with numerous references to authorities..... 13959

X. PSYCHOLOGY.—The Cerebro-Spinal Axis as a Thermal Center and Water Power.—By BENJAMIN WARD RICHARDSON, M.D., F.R.S.—A curious contribution to the theory of the mechanics of the human system, with practical application of the same to some forms of cerebro-spinal disease..... 13970

XI. RAILROAD ENGINEERING.—The Transandine Railway.—Present aspect of the railroad from the Argentine Republic through Chile.—Probabilities as to its completion and the business now done by it..... 13966

XII. TECHNOLOGY.—Apparatus for Cooling Water of Condensation.—A novel method of cooling water by aerial evaporation, a novel and effective method of leading to the problem.—1 illustration.... 13967
Benzine in Bleaching.—The use of benzine lye and also the use of benzine in the chlorine bath in bleaching operations..... 13973
Improvements in the Production of Bleaching Powder.—A recently patented process for saturating lime with chlorine gas.—2 illustrations..... 13968
Passenger Car Painting.—By ROBERT M'KEON.—Full details of inside and outside railroad car painting.—The harmony of colors and the proper materials to be used..... 13966
Color Harmony.—The technics of house painting as regards the harmony of the colors employed..... 13973

PROGRESS OF THE CHOLERA.

In Asia and Russia the cholera has carried off many thousands of poor people, chiefly by reason of the filth in which the victims lived and the lack of proper medical treatment. In Europe the disease made no alarming progress, except in Hamburg, where it was brought from Russia, and, owing to the dirty condition of the town and the supineness of the authorities in adopting proper sanitary measures, the advance of the disease became rapid and ominous. The tenement house dwellers especially suffered, and it is said upward of ten thousand of them succumbed. Hamburg is notorious for its crowded and filthy tenements.

As soon as the disease appeared in Hamburg prompt precautions were taken at nearly all other European seaports and principal cities to prevent the spread of the disease. These efforts were successful, and the progress of the pest appears to have been effectually stopped. Such great cities as London, Paris, Berlin, Vienna, although in direct communication with Hamburg and Antwerp, suffered but little. The few cases that occurred were immediately isolated, and suitable preventives extensively used.

It is a peculiarity of this disease that its spread may be readily checked and controlled by the early adoption of intelligent precautionary means and regulations. In New York due notice was received of the probable approach of the pest, and vessels arriving from infected ports were promptly quarantined. Steamers from Hamburg were rigidly guarded; the passengers were transferred to salubrious landing places, and wherever any sign of the disease appeared the case was at once isolated and skillfully treated. The result was the disease did not pass the quarantine grounds, and the great city remained exempt. New York at the present time is the healthiest large city in the country.

CHOLERA AND SOME INDICATIONS FOR ITS MANAGEMENT.

Considered in detail, the chief symptoms of this malady may be outlined as follows:

(1) Purging of a peculiar flocculent, rice water kind.

(2) Copious vomiting, at first with tinges of bile, perhaps, but later of thin, colorless and odorless fluid.

(3) Severe cramps in the lower extremities and abdomen, rendering the muscles hard and tense.

(4) Sometimes, in the early stage, albuminuria followed by complete suppression of urine.

(5) Diminished circulation and impeded respiration, causing intense prostration, with icy coldness of surface of the body, of the hands, the tongue and even the breath; perhaps, also, oppression and pain in the region of the heart.

(6) Frequently, noises in the ears, dimness of sight, and deafness.

(7) Marked depression of temperature, notwithstanding which the sufferer usually complains of oppression and prefers to lie uncovered; generally, too, both during collapse and reaction, the thermometer in rectum registers three or four degrees higher than in the axilla, and the latter is at least one degree lower than in the mouth.

The lividity and blueness of the lips and surface of the body generally is remarkable; at the same time the skin becomes shriveled and bedewed with death-like dampness. The sharp pinched appearance of the features, the muddy complexion, and the sinking of the eyeballs, with flattening of the corneæ, are so characteristic as to give rise to the designation *facies choleratica*. There is also alteration of the voice, which becomes whispering, hollow, and unnatural, owing to diminished volume of air in the lungs.

As the malady progresses, there is a gradual lessening of respiration, and, coincidentally (or nearly so), diminution or absolute disappearance of the pulse, the action of the heart being almost or quite inaudible. Finally, there is complete arrest of circulation. Death may occur any time from three to twenty-four hours after the first inception of the malady, depending upon the nature and severity of the attack, etc. But those that survive to the latter period frequently recover, often mending with wonderful rapidity.

An attack may be ushered in or preceded by a slight attack of diarrhœa; consequently, during an epidemic any looseness of the bowels is sure to be regarded with suspicion. Nevertheless, the disease not infrequently asserts itself without any form of premonition or warning. It may be borne in mind, however, that all diarrhœic or dysenteric discharges that occur during an epidemic are not necessarily choleraic. At such time there is always prevalent an intestinal flux that is distinct from cholera, and presents characteristics varied from simple diarrhœa up to cholerine; and it is of importance to discriminate between the two. The less formidable complaint presents alvine evacuations possessed of more or less consistency and tendency to formation, and, moreover, have in greater or less degree the characteristic odor of fæcal matter; the discharges of cholera, on the contrary, are odorless and colorless, chiefly made up of large quantities of watery fluid holding in suspension flocculent matters (flakes of mucus), hence the likening to rice water—water in which rice has been boiled, colorless, with shreds of albuminous matter derived from the cereal.

What the poison of cholera may be is still a moot question, and Koch's assertion it depends upon or resides in the *comma bacillus* is far from being conclusive. The symptoms that usher in a seizure indicate a form of poisoning so obviously, that the chief upholders of the bacillar theory have been compelled to hesitate and even inquire whether, after all, some ptomaine or other alkaloid may not be the specific virus. Finally, Drs. Lewis and Cunningham, of the army medical school at Netley, England, have shown the bacillus of Koch is constant in the mouth and throat of healthy persons; and though Koch rejoined his bacillus differed in size and shape, the accurate measurements undertaken by these gentlemen, in conjunction with Arthur E. Brown (and verified by Sir William Aitkin), and the reaction of the same to staining fluids, prove the precise contrary; again, though cholera fluid may be boiled and disinfected to the complete extermination of all bacilli, yet it fails to lose its characteristic infectious and toxic properties (Aitkin, Lewis, Cantani, Klebs). It is evident, then, the bacillus of Koch is not *per se* a cause; and time has only confirmed the utterance of Trichum, *a propos* of this microbe, that the purported discovery no more definitely settled the question of cholera than knowledge of the bacillus of tuberculosis will terminate pulmonary consumption.

It is certainly folly to prate of curing cholera when the very principles which should be a guide to treatment are undecided, antagonistic, and devoid of physiological basis. To this hour, among many—the majority, in fact—the question is mooted whether recovery depends upon *persistence* of the intestinal evacuation, or upon its *suppression*. That patients have recovered and do recover, under all kinds of treatment, often widely different and aggressively antagonistic, must be universally acknowledged. In nineteen cases out of twenty the remedies prescribed by mouth or by enema are returned unaltered in the vomit or the stool, else mingle with the fluids in stomach or bowels without being absorbed until the crisis is over, when they are very apt to prove mischievous.

Prior to the last epidemic in England, there were few practitioners who did not believe it a duty to check the so-called premonitory diarrhœa with astringents and opiates, and reports of thousands of cases might be collected wherein medical men believed that by this method they prevented the development of the stage of collapse, though it is plainly apparent the theory upon which such practice is based is very far from infallible. Further, the whole subject has been so complicated by the publication of immature hypotheses and extravagant conceits, and the views held by different individuals seeing the same class of cases in the same institution are so opposite, it seems difficult to form any trustworthy opinion. Physicians only after each epidemic learn the lessons they taught and the principles they inculcated with so great care and energy were possessed of no real value—in reality had a mischievous tendency. Taking these circumstances into consideration, the bewildered practitioner may well ask, "What shall be done?"

It is strongly advised to scout all extravagant plans of treatment and not worry the sufferer with nauseous remedies that, to say the least, have time and again proved utterly useless. First, isolate him, as far as possible, securing at the same time a plentiful supply of fresh air. Next, see that his drinking water is pure, particularly that it has not been drawn from or polluted by any sewer, or sink, or river that is or has been used as a cesspool. For obvious reasons, the rain barrel is safer than the well. Empty the sick room of all superfluous furniture, of curtains, carpets, etc., covering the floor and neighboring passages with sawdust or sand, wet with some disinfectant fluid, such as dilute solution of aluminum acetate or Labarraque's solution; and when removed, the same should be wholly burned or purified by fire. Sulphurous acid gas may also be used for fumigation purposes. All excreta invariably must be received in earthen pans containing strong disinfectant fluid, and at once cremated or buried—certainly not thrown into drains, sewers or stream. Finally, the soiled body and bed linen should be soaked in an antiseptic solution (solution of corrosive sublimate, if desired), or in boiling water containing some disinfecting powder and afterward washed with carbolic soap. Better if they, too, should be burned.

It need scarcely be added, the importance to the community of the preventive methods just outlined against infection can scarcely be exaggerated.

An attack of diarrhœa must on no account be neglected. The sufferer should at once be sent to bed, kept quiet, carefully nursed, and allowed to drink freely of soda water, plain, pure ice water, cold coffee, or milk and water, as often as thirsty; either cold or warm tea is quite prone to provoke or increase nausea when there is a choleraic tendency. Farinaceous foods, with well salted beef or mutton broth, may be taken as demanded or desired. Poultices may be ap-

© 1892 SCIENTIFIC AMERICAN, INC.

plied to abdomen for relief of pain, or, better still, half a dozen thicknesses of flannel saturated with a mixture of chloroform and alcohol (one to twelve) and covered by oiled silk or rubber cloth to prevent evaporation.

Any suggestion of sinking or faintness may be controlled by gentle stimulation, but all drugs having a tendency to either encourage or repress looseness of bowels are best avoided. In the stage of collapse efforts are to be directed toward the restoration of animal heat; friction, turpentine stupes, sinapisms, dry and hot flannels and blankets, hot bottles to feet and sides, etc., here may find useful places; likewise recourse may be had to enemata of hot water containing small quantities of potassium chlorate or of common salt. While there seems to be a prejudice on the part of medical men against warm baths, Dr. Tanner states as a fact that in 1866, at the London Hospital, prolonged immersion at temperature from 98 to 104 degrees Fah. certainly did no harm, while it "frequently proved so grateful it was difficult to get the patient out of the water."

To relieve the thirst, weak saline lemonade containing chlorate of potash and other salts has often been preferred to plain water, and if the arguments which at first sight seem strong in favor of allowing such drinks are unsound, still nothing can be alleged against the practice. During the whole of the third stage, the recumbent posture is strictly to be maintained, the patient being lifted on a sheet and blanket into the bath, if one be given.

With reference to other medication, it may be fairly said that the chances of recovery are probably lessened by the use of astringents, opiates and alcoholic drinks in general, and the evidence in favor of the opposite course—use of emetics, purgatives, etc.—is very far from being satisfactory.

Be the origin of cholera what it may, miasmatic, ptomainic, bacillar, telluric or meteorologic, its neurotic character is most plainly manifest. As far back as the time of Cullen, the malady was classed in the "*order* Neuroses, *class* Spasms." Sir Henry Macormac, who had extended experience in the epidemic of 1834 in Ireland, regarded it as provoked by a lesion of the abdominal sympathetic system, a view ably corroborated by Charles Lever, and subsequently upheld by Sedgwick, Johnson, Claude Bernard, D'Arsonval, the elder Chirmac, Pisani, Cannatacci, Michael Foster, and especially Alexander Hackin. The influence of the nervous system is most clear, both in subjective and objective symptoms. The vomitings and numerous stools evidently result from either a paralyzed or hyperæsthetic abdominal sympathetic, two conditions that, apparently antagonistic, are physiologically the same, differing only in degree, the latter depending upon the intensity of the poisoning; the crises, cramps, vertigo, anxiety, spasms and tremblings, also are of neural origin. Further, the entire series of symptoms are precisely parallel in the toxic manifestations of certain cadaveric alkaloids, and also of muscarin (both a cadaveric and vegetable derivative), one of the most powerful nerve poisons known. Finally, the rapid deaths due to so-called cholera sicca (dry cholera), which are observed during epidemics and in patients which have previously enjoyed good health, can only result from powerful influences brought to bear upon certain nerve centers, since they are for the most part preventable by the use of remedies that have direct influence upon the solar plexus, notably hydrocyanic acid, alone or in combination with chloroform.

The practical application of an admitted physiological and pathological principle, and the discovery of the constant relation of cause and effect, suggest the idea of a well defined law in this affection. It is, moreover, to the sympathetic system that must be referred the depression of the functions of respiration and circulation, which constitute the gravest factors in cholera; therefore, in antagonism of the sympathetic is afforded a key to rational, physiological treatment.

The fact may be recalled that the pneumogastric (vagus) is an inhibitory nerve, and possesses an action antagonistic to that of the sympathetic on the heart; that it unites with the latter in forming three plexuses —pharyngeal, cardiac, and solar. By stimulating the sympathetic part of the heart, its contractions are augmented, but by acting thus on the vagus, it is possible to arrest the heart in full diastole. The stimulation of the vagus then gives rise to an important indication, namely, the re-establishment of the cardio-inhibitory functions of this nerve, which are evidently absent in cholera. By so doing, the violent contractions and palpitations will cease; the energies of the heart cavities, especially those of the left side, are restored, and the congestion of the pulmonary and cutaneous systems disappears. Simon and others have shown that in cholera the left side of the heart is generally emptied, while the right side is distended and filled with blood; Sieluna and Bruce, performing autopsies on patients who succumbed at Malta during the epidemic of 1877, always discovered the cavities of the left heart empty, and those of the right filled with blood; and George Budd (in *Medical Chronicle*, vol. xxi.) notes concentric hypertrophy in all cases of sudden death from cholera, and, moreover, cites the experience of M. Jackson, who, in 1832, observed the hearts of persons who succumbed to this disease often presented hypertrophy of the left ventricle.

In all attacks of cholera, then, regardless of stage, the first indications are to stimulate the vaso-inhibitory apparatus and antagonize the sympathetic, especially its solar plexus, by sedation, by reflex, or both. The remedies most available for such purposes are, in order: 1, hydrocyanic acid; 2, chloroform; 3, Indian hemp; 4, morphine. Happily we have these all, with capsicum added, in the combination entitled chlor-anodyne, a preparation that is not alone an improvement upon the old proprietary chlorodyne, but by the dropping of certain inert and nauseous ingredients is likewise far less antagonistic to a sensitive or irritated stomach. The action of this fluid is in a measure dual, in that it allays the irritation induced by poisoning of the sympathetic, and at the same time stimulates the vaso-inhibitory apparatus, thereby relieving the spasmodic congestion of the arterioles that leads to oppression and depression of both cardiac and pulmonary functions. The preparation is still further available, in that it is intensified by the powerful revulsive effect of the contained capsicum.

Next, if chlor-anodyne is insufficient, the sympathetic may be further and more powerfully antagonized by stimulation of the pneumogastric as advocated by Dr. Alexander Hackin, and so successfully employed in Malta during the epidemic of 1887. Three preparations are available for this purpose: one, an essence of mustard oil; another, equal parts of saturated tinctures of ginger and capsicum; finally, the epispastic liquor of the British Pharmacopœia (percolation of five parts cantharides with twenty parts acetic ether); and these should be applied freely over the branches of the pneumogastric in the neck—in front, beneath and behind the ear, covering three inches of surface, preferably on the right side (Coleman having demonstrated the right vagus commands the smaller intestines). If the case be one of extreme urgency, the liquid may be applied underneath the eye, and, if desired, both right and left vagi excited. The effect is almost instantaneous, and all morbid phenomena, if mitigated at all, are usually annihilated before vesication can take place. With the first two preparations vesication may generally be avoided; but in cases of extreme collapse the epispastic liquid should receive entire preference, chlor-anodyne being at the same time given by the mouth in sirup or on sugar, in full doses of 30 minims. By developing the inhibitory power of the vagus, vomiting, purging, and cramps are rapidly arrested, the pulse regains its power, bodily temperature is increased, and the patient speedily falls asleep.

According to Prof. Pisani, Chief of the Health Service of Malta, cholera made its appearance in that island on the 25th of July, 1887, and the mode of treatment outlined above was begun on the 31st of the following August. In his report to the government he remarks: "The amelioration was very rapid."

Dr. Inglott, Surgeon of Zabbor Hospital, says: "It has often succeeded in the gravest cases where other treatment had proved futile, not only in my hands but also in those of my friend Dr. Cannatacci, of Zeitum Hospital. We worked together, and every day exchanged observations on this important subject. This treatment often gave us astonishing results, and my sincere conviction is that thereby we were enabled to save many patients from death. I recall, among others, that of a poor child of eight years, who was so cold there seemed to be no hope; all tried remedies had proved useless, and when I saw him in the morning he was dying; in the afternoon he was convalescent, and all this had been accomplished by profound antagonism of the sympathetic."

These observations require no special comment, and it would be useless to dwell on the importance of rapidity of treatment in an affection where moments are so precious. The sleep which the revulsive fluid (externally) secures in connection with chlor-anodyne (internally) and the re-establishment of a balance between circulation and respiration, tend not only rapidly to abort the malady, but also to oppose the typhic condition or secondary fever that frequently is a convalescent sequel.

After all, the treatment of maladies is part of their pathology; the nature, the power of the remedy, and the modifications that follow its action are the surest guarantees of the character and tendency of the disease.

Novel Geological Ideas.

The presidential address before the British Association, Section C, of Prof. C. Lapworth, LL.D., concludes as follows:

The account of the simple rock-fold I have already given you is of the most elementary kind. It presupposes merely the yielding to tangential pressure from front and back, combined with effectual resistance to sliding. But in the layers of the earth crust there is always, in addition, a set of tangential pressures theoretically at right angles to this. The simple fold becomes a *folded fold*, and the compound septum twists not only vertically but laterally. On the surface of the globe this double set of longitudinal and transverse waves is everywhere apparent. They account for the detailed disposition of our lands and our waters, for our present coastal forms, for the direction, length, and disposition of our mountain ranges, our seas, our plains, and lakes. The compound arch becomes a dome, its complementary trough becomes a basin. The elevations and depressions, major and minor, are usually twinned, like the twins of the mineralogist, the complementary parts being often inverted, and turned through 180° (compare Italy with the Po-Adriatic depression). Every upward swirl and eddy has its answering downward swirl. The whole surface of our globe is thus broken up into fairly continuous and paired masses, divided from each other by moving areas and lines of mountain making and crust movement, so that the surface of the earth of the present day seems to stand midway in its structure and appearance between those of the sun and the moon, its eddies wanting the mobility of those of the one and the symmetry of those of the other. In the geology of the earth crust, also, the intercrossing of the two sets of folds, theoretically at right angles to each other, gives rise to effects equally startling. It lies at the origin of the thrust plane or overfault, where the septal region of contrary motion in the fold becomes reduced to, or is represented by, a *plane* of contrary motion. It allows us to connect together under one set of homologies folds and faults. The downthrow side of the fault answers to the trough, the upthrow side to the arch, of our longitudinal fold; while the fault plane itself represents the septal area reduced to zero. The node of the fault, and the alternation and alteration of throw, are due to the effects of the transverse folding.

These transverse folds of different grades, which affect different layers of the earth crust differentially, account also for the formation of laccolites, of granitic cores, and of petrological provinces; and they enable us also to understand many of the phenomena of metamorphism.

Of the folds of the third order I shall here say nothing; but I must frankly admit that the primal cause of all this tangential movement and folding stress is still as mysterious to me as ever. I incline to think that it is due to many causes—tidal action, sedimentation, and many others. I cannot deny, however, that it may be *mainly* the result of the contraction in diameter of our earth, due to the loss of its original heat into outer space. For everywhere we find evidences of symmetrical crushing of the earth crust by tangential stresses. Everywhere we find proofs that different layers of that crust have been affected differentially, and the outer layers have been folded the most. We seem to be dealing not so much with a solid globe as with a globular shell composed of many layers.

Is it not just possible after all that, as others have suggested, our earth is such a hollow shell, or series of concentric shells, on the surface of which gravity is at a maximum, and in whose deepest interior it is nonexistent? May this not be so also in the case of the sun, through whose spot-eddies we possibly look into a hollow interior? If so, perhaps our present nebulæ may also be hollow shells formed of meteorites. On the surfaces of these shells the fiery spirals we see would be the swirls which answer to the many twisting crustal septa of the earth. Our comets, too, in this case might be elongated ellipsoids, whose visible parts would be merely interference phenomena or sheets of differential movement.

In this case we have represented before us to-day all the past of our earth as well as its present. Uniformity and evolution are one.

Thus from the microscopic septa of the laminæ of the geological formations we pass outward *in fact* to these moving septa of our globe, marked on land by our new mountain chains, and on our shores by our active volcanoes. Thence we sweep, *in imagination*, to the fiery eddies of the sun, and thence to the glowing swirls of the nebulæ; and so outward and upward to that most glorious septum of all the visible creation, the radiant ring of the Milky Way.

Snow Sheds Burned.

There were four fires in the Central Pacific snow sheds at Summit on the night of September 9. The Summit fire train while fighting flames became surrounded by fire and had to be abandoned. The engine and water cars were wrecked by the flames. The Blue Cañon water train was hurried to the scene, but a new fire started west of the train, and for a time there was imminent danger that this train would also be destroyed. The water train from Rocklin was sent up early next morning and the flames got under control. Twenty-one hundred feet of sheds and track were destroyed and four passenger trains blockaded. The press dispatches reporting these facts state that the fires were incendiary.

A correspondent of the *Confectioners' Journal* says that banana juice makes a first-class indelible ink. A spot on a white shirt from a dead ripe banana is marked forever, and the juice from bananas thoroughly decayed is a bright, clear carmine.

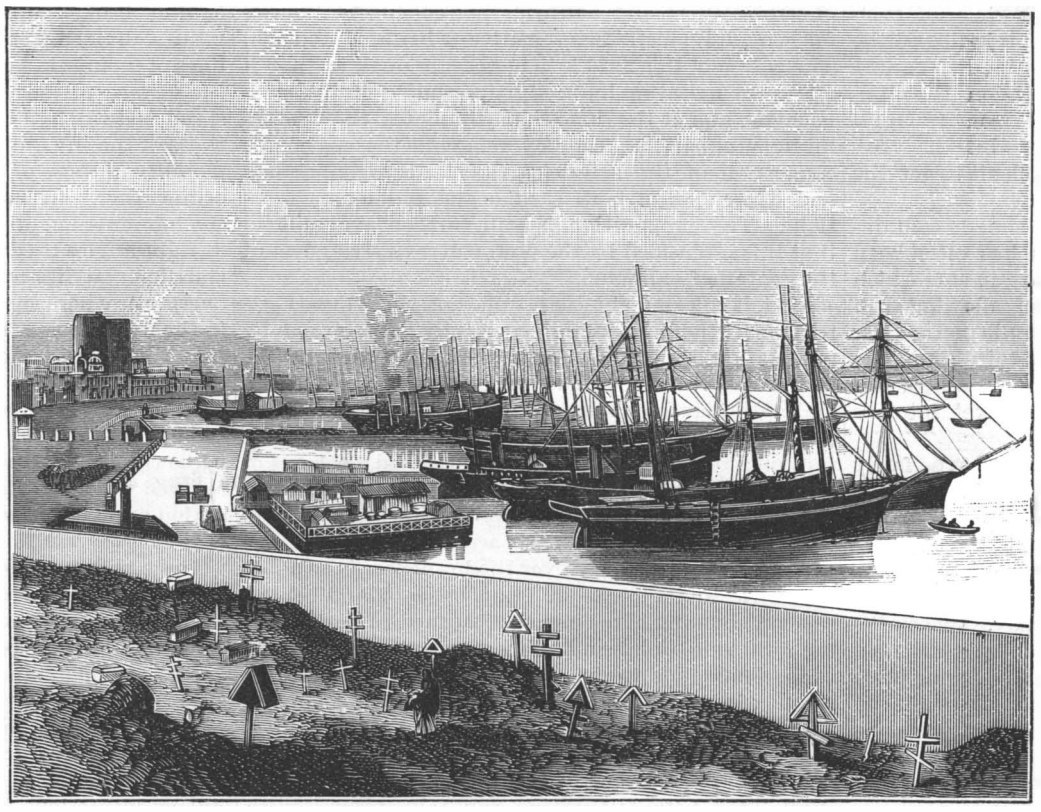
© 1892 SCIENTIFIC AMERICAN, INC.

BAKU.*

The accompanying illustration, from a recent photograph, shows the most important business portion of the principal seat of the Russian petroleum industry, on the Caspian Sea. The town has but lately had a very severe visitation of cholera. The house on the extreme left is that of the Governor of Baku, and the roadway for about fifty yards in front on each side is asphalted. All tramcars must proceed at a walking pace, and not stop to take up or set down passengers while on this stretch of road. Further to the right is the Customs House, beyond which is the "Virgin's tower," an ancient structure now used as one of the harbor lights for ships coming into the port. To the extreme right may be seen the warehouses and works of the Kaucus and Mercurie Company, the largest ship-owners on the Caspian Sea and the Volga. This company has a fleet of nineteen steamers—*i. e.*, thirteen screw steamers, with a total of 5,670 horse power, the largest, the Jandr, being of 1,200 horse power, and six paddle steamers, of 4,656 total horse power. The largest paddle steamer is the Admiral Karnelov, whose dimensions are length, 248 feet, breadth, 30 feet, and depth, 16 feet 8 inches, and fitted with engines of 950 horse power. This company has the contract for conveying the mails over the Caspian Sea. At the opposite end of the bay, the distance being about two miles, are the government dockyards of Bielof. In the old town, which is inclosed by a wall from 12 feet to 16 feet in thickness, some of the streets are very narrow. The artificers may be seen sitting at the front of their shops making shoes, Persian slippers, Astrakhan and Bokhara caps, and articles in gold and silver. The population of Baku at the end of 1890 was about 104,000. Our illustration is from *Industries*, London.

The supply of crude petroleum at Baku is apparently inexhaustible, but until within the last ten years the town has been practically isolated from the rest of Europe, a long and troublesome journey being required to get to it. This has now been changed, and Baku at present has steam communication with all parts of Europe. The Nobel Brothers have borne a prominent part in developing the petroleum industry here, laying the first pipe lines, employing tank steamers for conveying the product, and taking the lead in employing petroleum as fuel for the steamers. There is now not a vessel on the Caspian using wood or coal, liquid fuel being employed exclusively.

* For illustrated description of the "Russian Petroleum Industry at Baku," see SCIENTIFIC AMERICAN SUPPLEMENT, No. 439.



THE HARBOR OF BAKU.

Bitumen Oil and Gas in France.

Certain districts in Auvergne, France, are very rich in deposits of bitumen. There are three varieties equally abundant, the liquid, bituminous limestone, and the bituminous sandstone. The mineral is met with at a few feet from the surface. The seams of bituminous limestone are in some places 200 feet thick. The mines have never been worked beyond 80 or 100 feet. The mineral gives oil and gas by distillation, but as experiments have been made only on the bitumen near the surface, of course it gave but small quantities of light oil. The bitumen extracted by boring deeper contains more volatile oil. At a depth of from 500 to 600 feet inflammable gas comes up through the bore. The only use to which the mineral is turned, at present, is for the manufacture of paving blocks. The bituminous limestone is used for this purpose; it is crushed into powder, a small quantity of liquid bitumen and sand added, and then the mixture is put into moulds and submitted to very high hydraulic pressure, and the blocks thus turned out are in the form of bricks or tiles as required. They resist perfectly well the action of heat; the trials made in different towns where they have been employed for paving the streets have turned out most satisfactorily. The work is very neat, and it costs less than the ordinary paving stones. The boring in search of petroleum continues very slowly, on account of the pressure of the gas, which drives up the sand and soil into the tubes to a height of 100 meters and prevents the working of the bores. It is thought they lack the proper machinery for the purpose, also the necessary experience in such work. There can now be no doubt about oil existing at a certain depth; it comes up already on the surface of the water. There is an opportunity for experienced capital to test these deposits of bitumen, which, it is believed, would yield good returns for the investment.

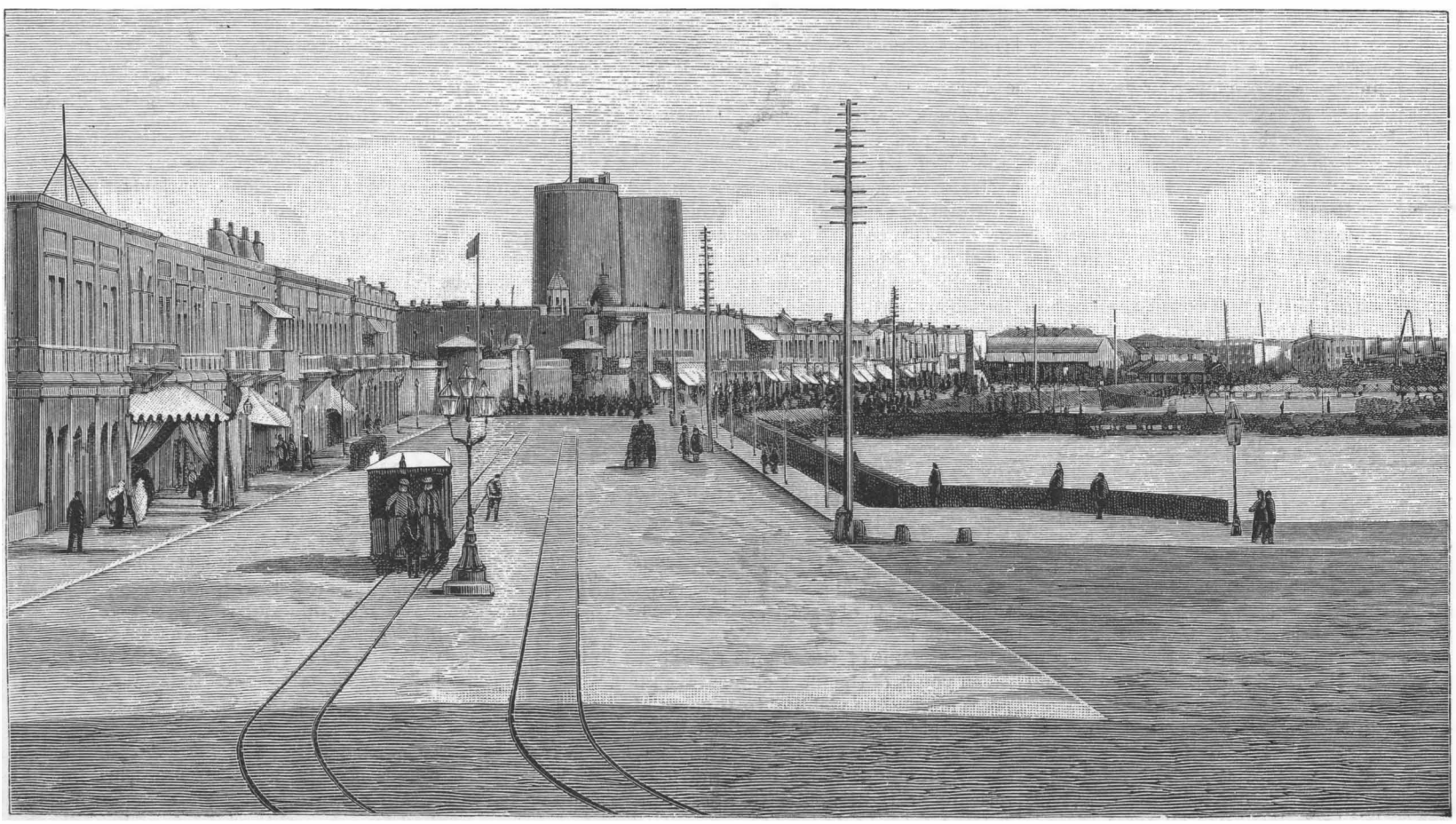
Russia the Headquarters of Famine and Disease.

One of the most engrossing things of late in New York has been the cholera and what they are doing at Quarantine to prevent its entrance into the city. With this dread disease knocking so urgently at our gates, it may be interesting to learn what men known for careful scientific research are disposed to say as to its origin.

Mr. Geo. W. Dunn, president of the Standard Chemical Works, says: "The principal cause of this appalling disease is the failure of the Russian crops last year. Our minister at St. Petersburg, the Hon. Charles Emory Smith, states that there are from fourteen to sixteen millions of people in absolute want of the necessaries of life and dependent upon measures of relief for continued existence." He also says: "The area over which the famine prevails is ten times as large as the State of New York. It contains a population of more than thirty millions. More than one-half are in utter helpless destitution, without food and without means of getting it. There are other millions who are reduced to abject penury and who can sustain themselves only in the most precarious way, and when to this reign of gaunt hunger we add the ravages of disease, the epidemic of typhus, the suffering from the severities of a specially rigorous winter, the decimation of stock and destruction of material, and the consequent difficulties of recuperation, we have a picture of widespread distress which can hardly be overdrawn."

With such a state of things existing in Russia, and added to this the brutal efforts of the Czar to drive those of Jewish religion out of his domains, it is no wonder, says *Architecture and Building*, that this disease is scattered through the ports of Europe and that it is threatening the whole civilized world.

INASMUCH as sewage does not constitute a well-balanced manure, but is relatively deficient in phosphoric acid, sewage farms, unless their soils are specially rich in phosphoric acid, should be manured with bone meal or Thomas slag meal, otherwise the crops raised on them will not be of normal and perfectly sound growth. —*N. A. Pearson.*

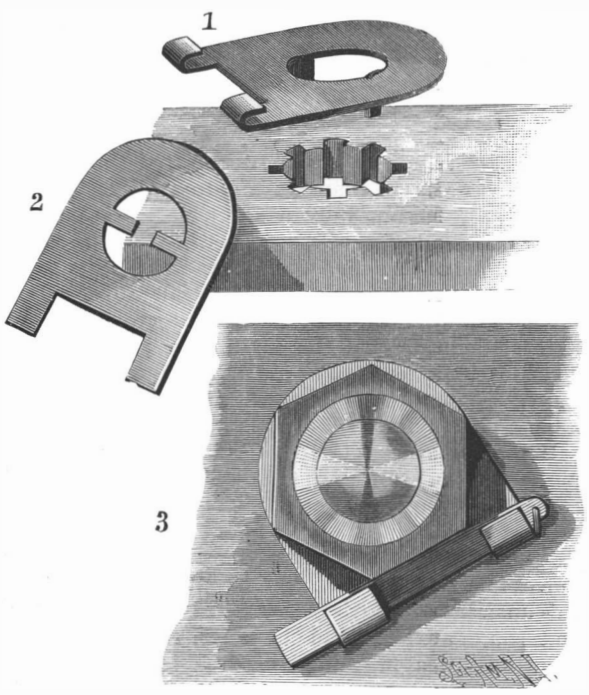


BAKU, THE HEADQUARTERS OF THE RUSSIAN PETROLEUM INDUSTRY.

© 1892 SCIENTIFIC AMERICAN, INC.

AN IMPROVED NUT LOCK.

The accompanying illustration represents a simple, very efficient, and inexpensive form of nut lock, designed, when properly set, to prevent any turning or loosening of the nut, a key holding the lock from any possibility of loosening. This improvement has been patented by Mr. William Schauweker, of No. 201 Colwell Street, Pittsburg, Pa. Fig. 1 shows the lock plate and the seat for the lock, Fig. 2 representing the

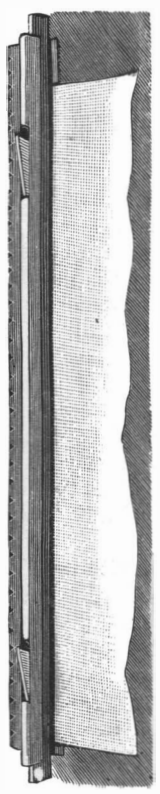


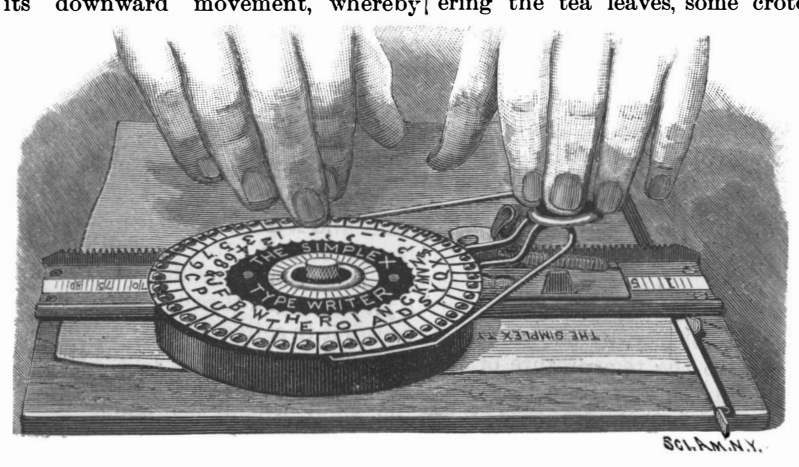
SCHAUWEKER'S NUT LOCK.

blank of the lock plate as it is punched out and before being bent into form, while Fig. 3 shows the application of the improvement, the key being in place in the lock. The grooves at the sides of the bolt hole in the lock seat are adapted to receive the feathers bent downward from the sides of the central opening of the lock plate, and the two ears at the ends of the lock plate, when bent upward as shown in Fig. 1, form a groove in which slides a wedge-shaped key, the key being kept from coming out by a wire pin or loop. In applying the lock the nut is to be screwed down until, when the key is placed in position, it will fit snugly against a flat side of the nut, the plate being placed so that its feathers will engage the proper notches in the lock seat to enable this to be effected.

A SIMPLE AND EFFICIENT TYPEWRITER.

The small, compact, and very inexpensive typewriting machine shown in the illustration, which with its box weighs only one pound, has been patented by Mr. Analdo M. English. The carriage way is attached to a light wood base, and is of sheet metal, having at one edge a vertical flange with rack teeth for engaging the feed devices, and grooves forming a guide for the carriage, on which all the operative parts of the printing and carriage-feeding devices are mounted. A printing disk and index wheel are pivoted for horizontal movement in unison in either direction in a casing secured to the carriage, and the index wheel has radial spring fingers on which are characters corresponding to those on the under side of the printing disk, each of these fingers also having a projection to be pressed upon by the finger of the operator in rotating the disk. As the index wheel is thus rotated the desired character is brought into alignment with and its finger is depressed into a notch in the casing on the side next the operator, a corresponding character on the rubber printing disk being at the same time brought beneath the type-impressing devices, the letter being thus locked when the impression is made. The impression frame is of wire, and from it extends an operating key, a spacing frame being also operated on by the key in its downward movement, whereby the carriage is moved along the space of a letter each time the key is depressed, the depression of the wire spacing frame, under the key, moving the carriage for spacing when the key is not depressed. In order to return the carriage when it reaches the end of a line, it is only necessary to press upon a small finger piece controlling a spring detent and pawl, when the carriage and its appurtenances may be moved backward to begin another line. The length of line, as the machine is at present made, is eight inches. The paper is shifted by hand for line spacing, being held therefor in a paper holder in the form of an elongated clip, as shown in a separate view. The clip has a vertical member sliding in a guide groove in the base. The inking is effected in a simple manner by inking pads at each side of an opening in the casing near the impression frame. The machine is readily and rapidly operated when held in any position, and the letters printed appear in plain view as fast as they are made. It will go into a box 5 inches wide, 9 inches long, and 1½ inches deep, so that it may be carried in the pocket. It is a typewriter evidently intended for use in the various professions and for private correspondence.



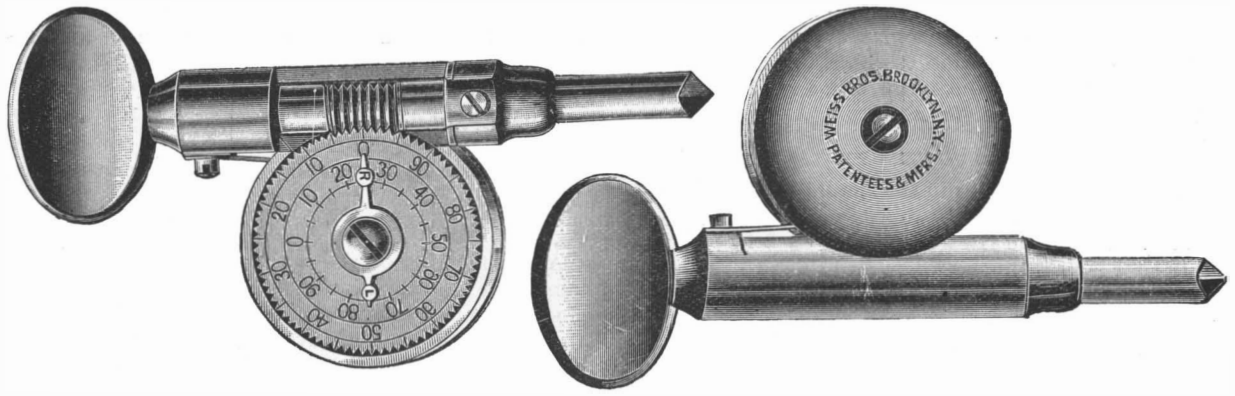


ENGLISH'S "SIMPLEX" TYPEWRITER.

Further information relative to this improvement may be obtained of the Simplex Typewriter Co., No. 32 Great Jones Street, New York City.

AN IMPROVED SPEED INDICATOR.

The neat and well finished device, shown full size in back and front views in the illustration, has some decided advantages which will at once commend it to all who have occasion to test the speed of running machines. It does not matter whether the shaft is turning to the right or to the left, the indicator is always in proper position to be applied, and requires no turning to zero. The distinctive merit of this device consists in its alarm bell attachment, the bell ringing at every hundred revolutions of the spindle, so that it is only necessary to place the indicator in position and count the strokes upon the bell as the eye follows the hands upon the watch dial. The friction caused by the pressure against the shaft is reduced to a minimum by the use of a hardened stub steel socket in which the hardened spindle rests and turns. No especial care need be taken to hold the indicator exactly true. When the speed is wanted of a shaft running in a dark corner, or in a position not easily accessible, the many advantages of this convenient device will be readily understood. It is nickel plated, and may be readily carried in the vest pocket. It has been patented and is manufactured by Messrs. Weiss Bros., machinists, Nos. 855 and 857 DeKalb Avenue, Brooklyn, N. Y.



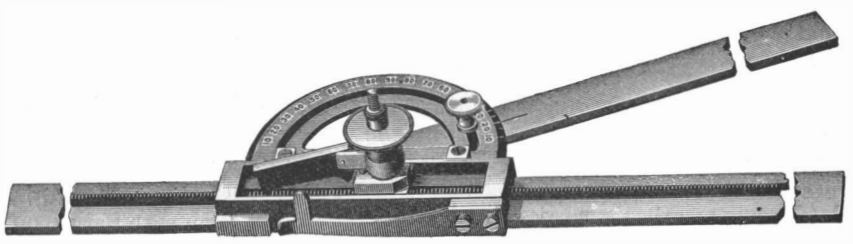
THE WEISS DOUBLE SPEED ALARM INDICATOR.

Croton Trees in Tea Plantations.

Some time ago a writer in the *Times of Ceylon* called attention to the danger in planting croton oil trees among tea bushes, as was then done on many places in the Matale district, since it was feared that, while gathering the tea leaves, some croton leaves might accidentally fall into the baskets and be manufactured into tea. Natives have a dread of the croton tree, as its poisonous properties are so well known to them that they fear even to pass under its shadow. Even native medical practitioners, in prescribing the oil obtained from the seed as a purgative, give only one drop as a dose for an adult. This is rubbed on a betel leaf, chewed, and swallowed. But the tea planters of Matale took no heed of this warning, till at last people in England began to make inquiries regarding the laxative quality of certain brands of tea sent from Ceylon, by the use of which several persons had been taken ill. Shortly after this almost all the croton trees on the tea estates disappeared. Planters who did not go in for tea and allowed their crotons to remain are now making some profit, as of late there has been a demand for the seed.

NEW MATHEMATICAL INSTRUMENT.

The engraving illustrates a new instrument for the use of engineers and architects, to be used as a section liner and scale divider. The base of the instrument consists of a bar having a longitudinal rack with twenty-four teeth to the inch. To the bar is nicely fitted a carriage provided with a central post, the upper end of which is threaded and provided with an adjusting nut. On the post below the nut is a collar which is pressed upwardly against the nut by a spiral spring. The collar carries a steel pawl which engages the rack, so that when the collar is pushed down, the carriage is forced to advance along the rack bar from one to six teeth at a time, according to the adjustment of the take-up. To the carriage is attached a semicircular protractor graduated to degrees. A ruler arm is pivoted to the protractor and is adjustable so that it may be placed at any desired angle.



BOTH'S SECTION LINER AND SCALE DIVIDER.

The use of the instrument as a section liner is obvious, the step-by-step motion being adjusted so as to move the ruler through the desired space after each line has been made. When the ruler arm is set at right angles to the rack bar, it will move with each pressure of the knob a distance equal to the number of teeth for which the take-up has been set, thus permitting of drawing lines $\frac{1}{24}$, $\frac{1}{12}$, $\frac{1}{8}$, $\frac{1}{6}$, $\frac{1}{4}$ of an inch apart. When the arm is adjusted at any other angle, the space between the lines will be diminished as the angle becomes more acute. By taking advantage of this fact, lines may be spaced in any desired ratio to the spaces of the rack bar. This ratio is the natural sine of the angle formed by the ruler and the rack bar. For example, if it be required to draw a scale of 12 to the inch, then we have $\frac{12}{24} = 0{\cdot}5$, which is the sine of 30°, or the angle to which the ruler arm must be set.

By means of this instrument any desired scale may be quickly constructed and accurately spaced. It is manufactured and sold by the Keuffel & Esser Co., 127 Fulton Street, N. Y.

Edison's New Jersey Village.

The village of Ogden, N. J., now known as Edison, has been built up within the last two years. The site is an old iron mine, known as the Ogden mine. It was abandoned many years ago, and until two years ago the vicinity was entirely deserted, and had grown up with shrub oaks and bushes. When Mr. Edison invented the magnetic ore separator, he organized the New Jersey and Pennsylvania Concentration Company, and a plant was established at Ogden, the name of which was then changed to Edison. The ore as taken from the mine is run through enormous crushing machines, and then passed through the Edison separator, where powerful magnets attract all the metal, which is afterward run into pigs.

New Remedy for Cabbage Insects.

The cabbage plants are sprinkled with ordinary corn meal while they are wet with dew or immediately after a rain, so the meal will cling to the leaves at all points.

© 1892 SCIENTIFIC AMERICAN, INC.

POSITION OF THE PLANETS IN OCTOBER.

JUPITER

is morning star until the 12th, and then evening star. He is foremost on October planetary annals, reaching the culmination of his course as far as terrestrial observers are concerned. This epoch is his opposition with the sun, on the 12th, at 1 h. 14 m. P. M. Several features give to the event a more than usual significance. The planet is in northern declination, which lengthens his stay above the horizon, and increases his meridian altitude, and, as he is only about two months beyond perihelion, he is nearer to the earth than he will be until he comes round to perihelion again in 1904. Jupiter, in opposition, is opposite the sun, rising at sunset, looking down from the meridian near midnight, and setting at sunrise. The synodic period of Jupiter, or the time it seems to take him to pass from opposition to opposition again, is 399 days, or a year and a little more than a month, a number easily remembered. The time for succeeding oppositions may be readily calculated. His opposition took place last year on September 5, this year it is on October 12, and next year November 15 will be the date. He passes at this time from the sun's western side to his eastern and is ranked as evening star. He reigns without a rival until Venus rises, and well deserves the name of prince of planets, for he is the largest and brightest of the clustering throngs that people the celestial vault. It is no wonder that ancient astronomers named him for their great god, that astrologers welcomed his ascendancy in the horoscopes they cast as a benignant influence, or that modern observers have a sincere admiration for the star that is the embodiment of strength and majesty. He is at his best in October, and a fine study for the telescope, when possibly some new light may be thrown upon the famous red spot that has puzzled scientific brains since 1878.

The moon, on the day of the full, is in conjunction with Jupiter on the 6th, at 0 h. 45 m. P. M., being 3′ north. The conjunction occurs when moon and planet are below the horizon, but the two heavenly bodies will be near neighbors when Jupiter rises about 6 o'clock on the evening of the 5th, and form a celestial picture that will be pleasant to behold. The moon will occult Jupiter to observers who see her in her geocentric position. She will also occult Saturn, Uranus, and Mercury under the same conditions.

The right ascension of Jupiter on the 1st is 1 h. 21 m., his declination is 6° 49′ north, his diameter is 47″.2, and he is in the constellation Pisces.

Jupiter rises on the 1st at 6 h. 8 m. P. M. On the 31st he sets at 4 h. 42 m. A. M.

VENUS

is morning star, rising in the small hours, and fulfilling her mission as herald of the dawn with queenly dignity. When she rises on the 1st at 2 h. 8 m. A. M., Jupiter is near the meridian, and the two rivals make a spectacle of surpassing beauty, the one, near her greatest distance from the sun, oscillating toward him, and the other beaming from the zenith, and rapidly drawing near that portion of his course where his luster is greatest. Venus, an inferior planet, oscillates east and west from the sun. Jupiter, a superior planet, makes the circuit of the heavens, and looks down from the zenith, amid the midnight darkness of the sky, a point beyond the reach of his fair rival.

The moon, four days before her change, is in conjunction with Venus, on the 16th, at 10 h. 8 m. A. M., being 4° 27′ north.

The right ascension of Venus on the 1st is 9 h. 41 m., her declination is 13° 3′ north, her diameter is 21″.4, and she is in the constellation Leo.

Venus rises on the 1st at 2 h. 8 m. A. M. On the 31st she rises at 2 h. 56 m. A. M.

MARS

is evening star. He was watched at opposition as planet was never watched before; but he has had his day and is receding from the earth, lessening in size and ruddy light, while October closes the season when he is of much importance. His diameter at the close of the month is only one half as great as it was at opposition. He makes his transit on the 1st at 8 h. 17 m. P. M., and sets at 0 h. 59 m. A. M., so that he is below the horizon when Venus rises, and has to yield the precedence to Jupiter until he disappears from view. Mars is in conjunction with the third magnitude star, Delta Capricorni, on the 25th at 6 h. A. M., being 1′ north of the star. The planet is below the horizon at the time of conjunction, but will be near the star on the night preceding.

The moon makes two conjunctions with Mars during the month. The first conjunction takes place on the 25th at 6 h. P. M., the moon being 1° 21′ south. The second conjunction takes place on the 30th at 0 h. 19 m. A. M., the moon being 2° 57′ south. It will thus be seen that the paths of the moon and the ruddy planet do not lie very near in October.

The right ascension of Mars on the 1st is 21 h. 2 m., his declination is 21° 6′ south, his diameter is 18″.2, and he is in the constellation Capricornus.

Mars sets on the 1st at 0 h. 59 m. A. M. On the 31st he sets at 0 h. 14 m. A. M.

MERCURY

is morning star until the 8th, and then evening star. He is in superior conjunction with the sun on the 8th, when, passing beyond the sun, he appears on the sun's eastern side and ranks as evening star. Mercury is in conjunction with Saturn on the 1st at 4 h. 35 m. P. M., being 34′ south. He is conjunction with Uranus on the 20th, at 1 h. 29 m. P. M., being 46′ south.

The moon, the day after her change, is in conjunction with Mercury on the 21st, at 8 h. 29 m. A. M., being 29′ north.

The right ascension of Mercury on the 1st is 12 h. 17 m., his declination is 0° 3′ south, his diameter is 5″.0, and he is in the constellation Virgo.

Mercury rises on the 1st at 5 h. 29 m. A. M. On the 31st he sets at 5 h. 22 m. P. M.

SATURN

is morning star. The incidents of interest in his October course are his conjunction with Mercury on the 1st, and he is also one of the three planets that are to be found in Virgo during the first part of the month, Uranus being the third member of the trio.

The moon, two days before her change, is in conjunction with Saturn on the 18th, at 4 h. 58 m. P. M., being 42′ south.

The right ascension of Saturn on the first is 12 h. 18 m., his declination is 0° 25′ north, his diameter is 14″.8, and he is in the constellation Virgo.

Saturn rises on the 1st at 5 h. 29 m. A. M. On the 31st he rises at 3 h. 49 m. A. M.

URANUS

is evening star until the 29th, and then morning star. He is in conjunction with the sun on the 29th, when he enters the ranks of the morning stars, because he is on the sun's western side. His conjunction with Mercury has been referred to.

The moon, the day after her change, is in conjunction with Uranus, on the 21st, at 6 h. 2 m. A. M., being 17′ south.

The right ascension of Uranus on the 1st is 14 h. 10 m., his declination is 12° 41′ south, his diameter is 3″.6 and he is in the constellation Virgo.

Uranus sets on the 1st at 6 h. 38 m. P. M. On the 31st he rises at 6 h. 19 m. A. M.

NEPTUNE

is morning star. His right ascension on the 1st is 4 h. 40 m., his declination is 20° 34′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune rises on the 1st at 8 h. 34 m. P. M. On the 31st he rises at 6 h. 34 m. P. M.

Venus, Jupiter, Saturn, Mercury and Neptune are morning stars at the beginning of the month. Mars and Uranus are evening stars.

THE FIFTH SATELLITE OF JUPITER.

A new member of the sun's family has made its advent since the position of the pianets was last chronicled. The new corner was as unexpected as is usually the case with celestial events of momentous importance. The fifth satellite of Jupiter has, however, come to stay. Barnard, who found the prize, has won immortal fame, and the Lick Observatory has at last done something worthy of the largest telescope in the world, and its fine location. There is not much to record concerning the new satellite. It was discovered on September 10, is 100 miles in diameter, shining as a star of the thirteenth magnitude, and revolving around its giant primary in about twelve hours, at a distance 112,000 miles from his center. It is difficult to tell whether the new moon is a blessing or a burden. Astronomers are puzzled to find a name for it, as Number 1 is already appropriated for the first satellite beyond it. Text books will have to be remodeled to recognize its presence in the sky. There is also a widespread popular disappointment that some important discovery about Mars, so ardently hoped for, could not have been made instead of this tiny moon that "flies swiftly round" the vast mass of Jupiter. At least, the Jovian moon of 1892 is not welcomed with the wild excitement that attended the discovery of the Martian moons in 1877.

About Sound.

Sound is transmitted to the ear by the vibrations of the air. When one particle of air is made to vibrate it sets the adjacent particles vibrating, and so a sound wave, if not obstructed, passes in all directions from the sounding body. The calculated velocity of sound in the air, when the temperature is at the freezing point, is 915·69 feet per second. But the experiments of Moll, Vaubeek, and Kuytenbrouwer, performed in 1823 over a distance of 57,839 feet, showed the velocity to be 1,089·42 feet per second. Laplace explained why it was that the actual velocity was greater than the calculated velocity, by showing that the sound vibrations increase the temperature of the air, and hence the sound travels faster than the calculated rate. This leads us to note the fact that an increase of temperature increases the velocity of sound by 1·11 feet per second for each degree of rise of Fahrenheit's thermometer. Hence sounds travel faster in summer than in winter, and in warm than in cold climates. It might be thought that sound would travel more slowly through a dense atmosphere, but the elasticity increases as rapidly as the density, and therefore the velocity of sound is not affected by varying density.

The velocity of sound in water, when at the greatest density, is 4,707·4 feet per second. The experiments by which this velocity was determined were made by M. Colladon in 1826, across the Lake of Geneva, from Rolle to Thonon, a distance of about nine miles. Water, therefore, transmits sound about four times as fast as air does. Still, water is not as good a medium for transmitting sound as the air. If a bell is rung under water and the sound transmitted through that medium for more than six hundred yards, the tones are not heard, but only a short, sharp sound, "like two knife blades struck together." Our atmosphere seems to be of just the right nature and density to give to sound its mellow tones and musical cadences. Nor is sound in water diffused around intervening objects as it is in the air. In the air a noise is carried with considerable intensity around a building or wall, but in water an intervening wall intercepts the sound almost entirely.

Here we turn aside to consider a question which, perhaps, has not often suggested itself, but which is, nevertheless, quite interesting. Why can we hear, but not see, around a corner? Some may think that this question can be answered by saying that light moves in a straight line, while sound does not. But this answer is not satisfactory. It is known that light and sound are similar in character; each is due to the vibrations of a medium, and each is transmitted in waves. Why, then, may not light spread around a corner as well as sound? The answer is to be found in the different lengths of sound and light waves. Sound waves themselves are of different lengths, the graver sounds having waves of greater length than the more acute. Now it can be shown mathematically that the greater length of sound waves will cause the sound to be diffused around the obstruction. Hence the bass notes of a band of music are heard more distinctly far behind a wall than the higher notes, and as the person moves out of the "acoustic shadow," the more acute notes increase in distinctness. So, also, when sound is transmitted through water the sound waves are shorter than in the air, and the "acoustic shadow" is fully formed. As the length of sound waves in the air is sometimes many feet, while the length of the longest light wave is not more than ·0000266 of an inch, it is no longer a mystery why we can hear, but cannot see, around a corner.

It is easily demonstrated that the intensity of sound varies inversely as the square of the distance from the origin of the sound. Generally speaking, a sound will be heard farther the greater its original intensity and the denser the medium in which it is propagated. The greatest known distance to which sound has been carried through the atmosphere is 345 miles, as it is asserted that the very violent explosions of the volcano at St. Vincent have been heard at Demerara. Sound travels farther and loses less of its intensity in passing through the earth than through the air. In 1806 the cannonading at the battle of Jena was heard in the open fields near Dresden, a distance of 92 miles, though but feebly; while in the casements of the fortifications it was heard with great distinctness. It is also said that the cannonading of the citadel of Antwerp in 1832 was heard in the mines of Saxony, which are about 370 miles distant.—*J. A. Moore, in Popular Science News.*

Preservation of India Rubber Goods.

In an article (*India Rubber World*) on "The Deterioration of Druggists' Rubber Goods," Mr. J. A. Sherman mentions a few of the causes which go to spoil this class of stock, and criticises the means which are taken to prevent deterioration. Fine surface cracks are taken as evidence that the goods are going wrong, and this may be due to (1) being kept in warm, dry air, as on top shelves in the shop; (2) exposure to sunlight; thus all goods shown in the window rapidly become bad. These are really the chief sources of trouble. As to the means of preservation, a New York manufacturer claims that small articles like catheters and tubes keep well immersed in water, but Mr. Sherman says that this is an impracticable method when generally applied. It has also been claimed that keeping the goods in air-tight boxes preserves, but this again is denied, and so is the statement that a coating of paraffin is beneficial. Paraffin mixed with unvulcanized rubber will destroy the latter in a short time, and it is very problematical whether it would not have the same effect on vulcanized goods. Exposure to the air is not considered to be detrimental, although a jet of oxygen directed upon an India rubber ball causes it to soften. On the whole, proper vulcanization is the only security that India rubber goods will keep well, and as long as they are stored in a part of the shop where the temperature is equable and moderate, the most is done that can be to prevent deterioration.

© 1892 SCIENTIFIC AMERICAN, INC.

MILITARY BALLOONING.

In Europe, the principal governments now have ballooning corps attached to their armies, by means of which observing balloons may be readily transported and quickly inflated on the field. In Germany, much attention has been directed of late to a new process of ballooning invented jointly by Herr Richter, a lieutenant of artillery, and Herr Majert, a scientific chemist, for depriving gas of the moisture it contains, and so lessening its specific gravity, to augment its power of raising and sustaining a balloon, with regard to the size of the balloon and the volume of gas. This process is deemed likely to supersede both the use of the special gas manufactured by the Yon system and that of the condensed gas which is supplied by English and Italian companies. The German military balloon car, also, as shown in our illustration, is suspended from a trapeze, which lessens its oscillation. We are indebted to the *Illustrated London News* for our engraving.

The rope-winding mechanism, by which the height of the balloon is regulated, is arranged upon a strong wagon, and is operated by a steam engine, the whole presenting the general appearance of a steam fire engine. The hydrogen gas for inflating the balloon is carried to the field in highly condensed form in separate steel cylinders. In operation a central steel cylinder, of larger size than the others, is laid upon the ground and the smaller cylinders are then attached to its sides. A flexible pipe at one end of the large cylinder conducts the gas to the balloon. Each cylinder has a stop cock by which the gas is allowed to escape into the balloon.

Soda Foam.

BY THOMAS WARWICK.

With soda water, as with stocks, "der brofit ist in de pubbles," and it is consequently not surprising that special foaming preparations are so often added to the sirups to produce the light and attractive head of foam with which the devotees of the soda water counter are so familiar. Of course it is not only to increase the dispenser's profits that foam is added, but also, as is the case with coloring matters, to please the eye of the customer, for what is more suggestive of cold than the snowy white froth on the brimming tumbler of soda?

Foam is a natural product, being caused by the escape of air or gas from a viscid liquid. In the case of soda water, it is the escape of the carbonic acid gas from the sweetened beverage that causes the attractive sparkling appearance; but the sweetened water alone would give rise to but a small quantity of foam, as the gas would too easily escape. In order to prevent this some mucilaginous substance is usually added to the sirup, which renders the mass more viscous, so preventing the gas from escaping and producing the attractive head of foam so familiar to all.

The question as to why all foam is white is not an easy one to understand, but the fact is that foam is always white, whatever may be the color of the beverage itself. The froth produced on a bottle of the blackest ink is white, and would be perfectly so were it not tinged to a certain extent by particles of the beverage which the bubbles hold in mechanical suspension. As to the cause of this whiteness it is sufficient to say that it is due to the large number of reflecting surfaces formed by the foam, for it is these surfaces which, by reflecting the light, produce upon our eyes the impression of white.

If we remember that all bodies owe their colors to the rays of light which they cannot absorb, and that all bodies which reflect all the light they receive, without absorbing any, appear perfectly white, we shall be prepared to understand how the multitude of reflecting surfaces formed by the foam, and which do not absorb any light, must necessarily give the froth a white appearance. It is for the same reason that any very fine powder appears white, even the blackest marble, when ground to dust, losing every trace of its original color.

Some people deplore the use of foaming preparations in soda water, claiming that such additions are totally uncalled for and unwarranted, but it must, nevertheless, be conceded that soda foam can bring forward several valid arguments in its own favor. In the first place, it aids greatly in keeping the gas from escaping too rapidly from the tumbler. In the second place, as before mentioned, it undoubtedly adds greatly to the dispenser's profits, for it is claimed that, by adding two ounces of foaming preparation to a gallon of sirup, the confectioner can draw fifty more glasses than without the foam. Thirdly, we must remember that the appearance of any article of food or drink plays fully as important a part as its taste in increasing the appetite and stimulating the gastric secretions, and when we bear all these facts in mind, we shall be inclined to look upon the snowy foam with more leniency. And, indeed, however we may look at it, there is no denying the fact that it has come to stay, and to stay probably for a considerable period of time, so we must make the best we can of the matter.

For producing a foam on beverages, three substances are in general use. These are soap bark, gum arabic, and the whites of eggs. Of the three, soap bark is the one usually preferred, as it is more stable than either of the others, and it is at the same time cheaper.

Soap bark is the inner bark of the *Quillaia saponaria*, a South American tree, and is shipped to this country in large quantities. It has a bitter taste, and its dust is most irritating to the eyes and nostrils. The bark is first crushed or ground, and its mucilaginous portions are extracted by percolating a mixture of alcohol, glycerine, and water through the bark, thus producing a foaming preparation which possesses many good qualities.

Gum arabic is seldom used for producing foam, owing chiefly to its high cost, but also to the fact that it is liable to fermentation and inversion, and is hence not suitable for bottled beverages or those which have to be kept for any length of time. Nevertheless many of the foaming preparations on the market go under such names as gum foam, foaming gum, Blank's gum, etc., although in most of them no gum whatever is used.

As regards the whites of eggs, I have mentioned them merely to condemn their use, for these are so unstable that, unless the sirup be used immediately, the eggs will decompose and give the beverage the disgusting odor of sulphureted hydrogen. Hence white of eggs should never be employed in making the sirup, not even for the dispensing counter. The only way in which eggs may be used at the soda fountain is in the shell, for the preparation of such drinks as eggnog, egg phosphate, etc., in which cases the egg is broken directly into the tumbler in the presence of the customer.

Hence, everything considered, soap bark must be accorded the palm for foaming purposes, although other substances are occasionally used, such as soap root, senega root, isinglass, glue, and a host of other mucilaginous bodies, but none of these possesses all the advantages of soap bark.

This point being decided, we come to the question as to whether it is better for the confectioner to make his own foaming preparations or buy them ready-made. While home-made extracts are bad enough as a rule, home-made foaming preparations "take the cake" for causing trouble in the shop. Simple as the process of manufacture appears, there are yet numerous points to be looked after in the preparation of the soda foam which none but an experienced chemist can hope to contend with successfully. For drinks that are dispensed the disadvantages are not so great, the sirups not being kept long enough to give much trouble, but those confectioners who bottle soda water should beware of using home-made foam, as to this may be traced a large number of standard soda water diseases, such as ropiness, cloudiness, precipitation, bitterness, etc.

In using foaming preparations it is well to deal them out with a parsimonious hand. Not only is it most vexatious for the thirsty customer to obtain a glass of "sweetened wind" instead of the refreshing beverage he desires, but the drink acquires a bitter taste, which does not in any way add to its attractiveness. Soap bark is naturally bitter, and, while it is imperceptible to the taste when present in small quantities, it yet becomes unpleasant when used in excess. In addition to this there is also the danger that if too much be used, it may not all be held in solution, and cloudiness and precipitation will then inevitably result.

Moreover, in all dark colored beverages there is another point which must be taken into consideration. It is that the sugar coloring used to produce the dark color will by itself produce a certain amount of froth, even without the addition of any special foaming preparation. In fact, in some beverages, such as root beer and sarsaparilla, this frothing is so great as to be a considerable impediment to the proper drawing of the beverage, so that in these cases some kind of an antifoam would be a great desideratum. Numerous attempts have been made to reduce this foam by mechanical devices attached to the draught arm, such, for instance, as filters or relief chambers for the escape of the gas from the beverage. None of these devices seems, however, perfectly satisfactory, and the man who would invent a harmless preparation to add to the sirup that would reduce the amount of foam without in any way impairing the quality of the beverage would confer a lasting benefit upon humanity, and perhaps upon himself as well. In an article published some twelve years ago in an English bottling paper, the author claimed to have discovered this very secret. He held that all oily matters tend to destroy foam, and he consequently claimed that all that was necessary to reduce the frothing of such drinks as root beer and sarsaparilla was merely to add to the beverage a small quantity of oil of lemon dissolved in spirits of wine in the proportion of one part of oil to five parts of spirit. One fluid drachm of this mixture, or even less, was to be added to every gallon of sirup.

The theory that oil would prevent foam seems plausible, for it is precisely for this purpose that oil is used on shipboard, to break up the small waves into one large, uniform sheet, and it would, therefore, seem at first sight as though the same effect should be produced in the soda water tumbler; but not having made any experiments myself in this direction, I give the statement for what it is worth.

When buying foaming preparations, the principal points to consider are: First, cheapness; second, lack of taste; third, keeping properties; fourth, convenience for use. A simple method of testing soda foam is to put a few drops of the sample to be tested in a tumbler and draw plain soda water upon it. You can thus ascertain how perceptible the taste of the foam will be, and can readily compare which of two preparations produces the densest and most lasting foam. Of course it must be remembered that in siruped beverages the taste will be less pronounced, and the foam will be denser and more lasting than in the plain soda; but this, nevertheless, forms a very convenient rough-and-ready test.

Another test which is sometimes recommended for comparing two samples of gum foam is to put a small amount of each in a bottle full of ordinary drinking water (without carbonic acid gas). The bottles should then be well shaken, and afterward allowed to stand. The foam produced will last several hours, and will serve as a fair test of the comparative value of the two preparations.—*Confectioners' Journal.*

The Young Men's Institute.

An institution that is doing good service for young men is the institute on the Bowery, New York, founded a few years ago by several philanthropic New Yorkers.

It follows more extensively the plan of work introduced by the Young Men's Christian Associations, and has courses of instruction in several branches of science. Among those that have been very successful has been the course on the "Theory and Practice of Steam Engineering," under the management of a practical engineer, Mr. William H. Weightman, M.E. At a small fee per month, instruction is given to those desiring to become engineers, in the practical operation of engines, boilers and machinery, and in the theory, rules and practice of the steam engine, boiler and transmission of power. Special information, not attainable in shop practice, is given pertaining to such matters as are required by examining boards, and particularly essential to the engineer, fireman, machinist, boiler maker and others, in the proper performance of their duties.

A new course on "Practical Electricity," under the charge of Mr. H. A. Benedict, of Cornell University, is to be inaugurated this winter.

It will include the imparting of a practical knowledge of the rules essential to the proper understanding of the principles of operation of the apparatus employed in the modern application of electricity.

The study of a text book on electrical arithmetic, illustrated lectures, the consideration of units of measurements, apparatus and methods of measurement, primary and storage batteries, incandescent lighting by direct and alternating currents, arc lighting, electric plating, direct current motors, electric traction, telephones and telegraphs.

There are departments in free hand and mechanical drawing and stenography. Located in one of New York's densely populated sections, the Young Men's Institute is doing a work which is greatly needed, and supplies instruction not readily obtained at the common schools. The institute also owns a good library, with a capacious reading room.

A Novel Fabric.

This invention consists of a novel frieze-like fabric and of the process or method of making it. For this purpose the well known knitted fabric or web is used, such as is produced on the circular, flat, or on any of the frames working with open, tongue, or ledge needles, and which has a backing of threads of wool, cotton, silk, or other fibrous material. This fabric, which is known as stockinet, shows on the one side the ordinary regular knitted meshes and on the other or rough side the threads of wool, cotton, silk, etc., bound by the finer threads of the knitted web. The fabric is first subjected to a nap-raising process, in any suitable napping machine, so as to convert the rough side into a fleecy state, and, for the purpose, a knitted fabric is used in which wool is the material that forms the threads of the rough side. The fleece produced by the napping machine, on the backing of the knitted web, is next submitted to the action of a friezing machine of suitable construction, in order to convert the fleece into a frieze-like surface, resembling lambskin, ratteen, or petersham. The fabric thus obtained is well suited for wearing apparel, or for decorative or other purposes. It may be dyed before the nap-raising process, in order to obtain the finished frieze-like fabric in any desired color. Or the wool threads, before being bound into the knitted web threads, may be colored or dyed so as to obtain any desired color in the frieze side of the finished fabric.

MANY of the explosions in flour mills have been traced to electricity generated by belts.

© 1892 SCIENTIFIC AMERICAN, INC.

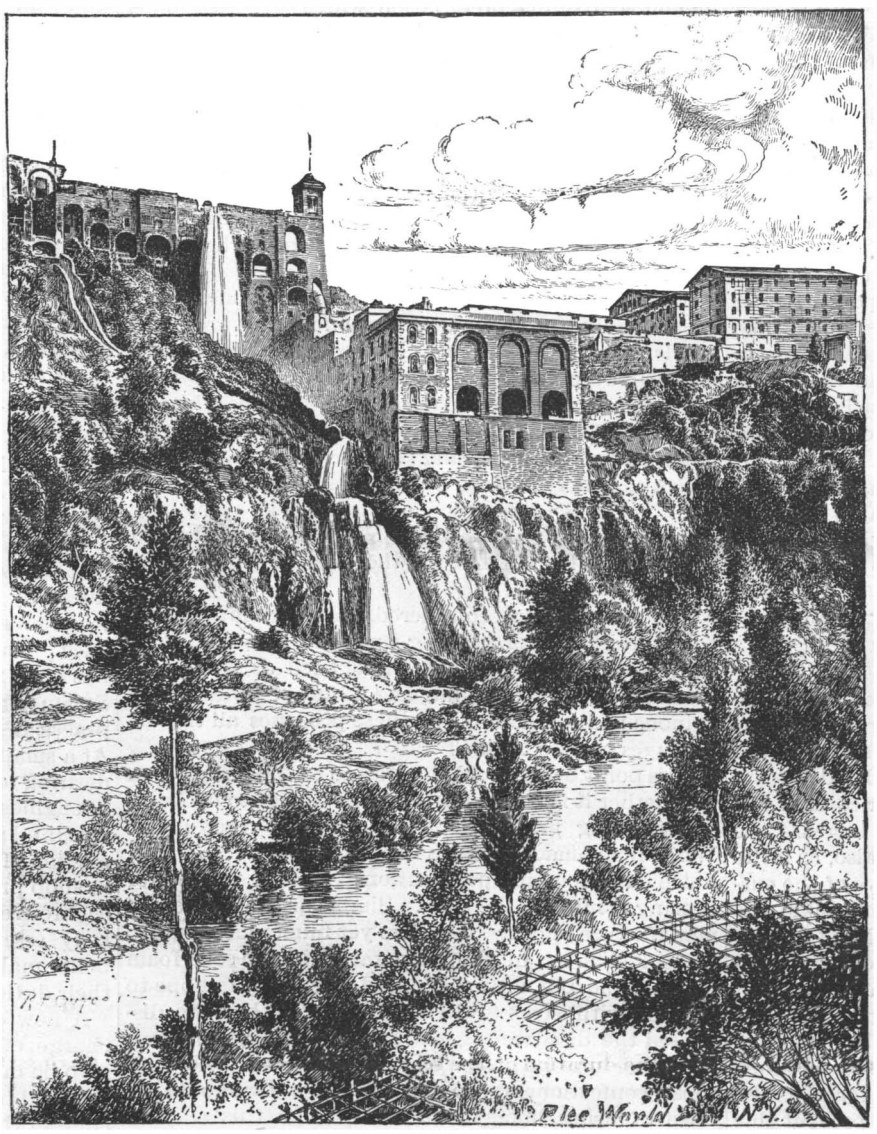
A LONG DISTANCE TRANSMISSION PLANT BETWEEN TIVOLI AND ROME.

AN interesting plant for the transmission of electricity for lighting and power is that recently opened at Tivoli, where the electric current, generated by water power, is used for arc and incandescent lighting in the city of Rome, some 17 miles distant. This plant was erected by the Roman Gas Company as a supplementary source of electricity to the central station at Rome. This company has been operating its station at Rome for six years, the source of power being steam engines having a total capacity of 2,700 horse power. This plant, together with the new station now in operation at Tivoli, is expected to supply the city of Rome with electric lights for public and private use, and with electric power wherever it is demanded for industrial purposes.

Tivoli abounds in cataracts as beautiful as they are useful, which have served for centuries as a source of power for various industrial enterprises. In 1887 an electric plant was established at Tivoli which is still in operation, but this is only of small size. It was constructed by the firm of Gaulard & Gibbs for supplying Tivoli with electric lights, the system used being the alternate current with transformers in series. Some years ago a company was organized for the purpose of utilizing the water power of the falls at Tivoli for the generation of electricity to be transmitted to Rome, but for various reasons the project was never completed. In 1888 the director of the Roman Gas Works, Mr. C. Panchain, took the matter in hand, and to him belongs the credit for having carried the enterprise to its present successful completion. The old and incomplete plant was purchased and the construction of the new station undertaken. This station is erected on the site of the old villa Mecenate, where a waterfall of 3¾ cubic meters per second, 110 meters in height, furnishes the necessary power. The water is carried through a canal on an old Roman viaduct to the wheel house. The canal terminates in a tower in which there is a stand pipe of sheet iron, 125 feet high and 50 feet in diameter. From the bottom end of the stand pipe a sheet iron pipe of the same width projects 150 feet further on and carries water to the level of the ceiling of the wheel house.

The station stands half way up the side of a mountain, as shown in one of our illustrations. The main room in which the dynamos and turbines are placed is 80 by 50 feet. The main pipe for conveying the water into the machine room is divided into three cross pipes, from each of which three vertical pipes lead out. These nine vertical pipes conduct the water to the nine turbines. A complete system of valves, which can be regulated by hydraulic pressure from the machine room, makes it possible to close each of the three cross pipes whenever necessary within a very few seconds. Corresponding with the three sets of pipes nine turbines form three groups, each group consisting of two 300 horse power turbines and one 50 horse power turbine. Each turbine is coupled direct to its corresponding dynamo. The turbines are of the Giraud type, the 300 horse power wheels having six inlets and valves, and the 50 horse power wheel having one inlet and a throttle valve. The former are constructed for 170 and the latter for 370 revolutions per minute. Each turbine is provided with a self-acting regulator of the Ganz system, which, by regulating the water supply, keeps the speed as accurately constant as is the case with the best types of steam engines. The turbines are completely inclosed in protecting cases, the water outlet being subterranean. In our illustrations one of the wheels is shown with the protecting cover removed. Every precaution has been taken to keep the machine room dry.

Each of the larger turbines drives an alternating current machine, which at 170 revolutions per minute supplies a current of 42 amperes, at a potential of 5,100 volts. The armature of each of these machines is 2·2 meters in diameter, and each generator has 30 poles. Each of the smaller turbines is coupled direct to a four-pole exciter, running at 375 revolutions per minute, and furnishing a current of 150 amperes at 180 volts electromotive force. Both the exciters and the large alternators are arranged in parallel. The exciters have hand rheostats. The regulation is effected by two automatic rheostats of the Blathy type in the field circuit of the exciting machines. These are so arranged that the electromotive force of the alternating currents is kept constant at the distributing station in Rome. The breaking of the circuit is effected by means of a dead resistance of iron wire.



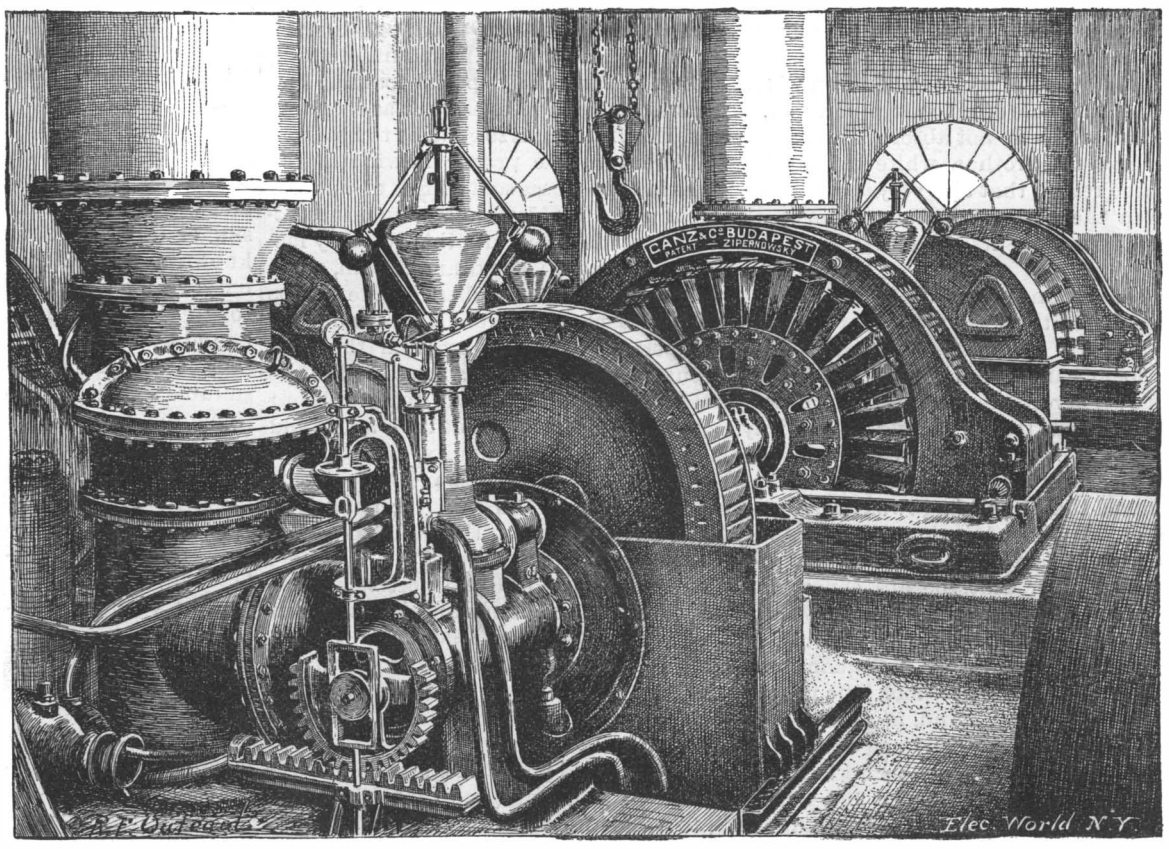
EXTERIOR VIEW OF THE TIVOLI CENTRAL STATION.

The conductors from Tivoli to Rome are carried through the deserted and forlorn Campagna Romana for a distance of nearly 17 miles. The leads consist of four copper cables, of 19 wires each, the entire system of conductors containing 100 tons of copper. These cables are so arranged that they can be exchanged at will in case of accidents or when repairs are necessary. Of the existing four cables, three are sufficient for running the entire plant, while two are sufficient for two-thirds of the load. The loss in transmission amounts to 20 per cent of the total pressure, that is 1,020 volts, the initial pressure being 5,100 volts. The cables are attached to very strong oil insulators placed upon poles or iron columns set from 115 to 130 feet apart. These poles consist of two parallel T-irons connected together by bolts, at the upper end of which are wooden uprights 10 feet in length, to which the oil insulators are fastened. The same line of poles carries silicon bronze wires for telegraph and telephone purposes, the lowest wire being 25 feet above the ground.

The conductors from Tivoli terminate at the old Roman wall, near the Porta Pia, in a small building, where the necessary transformers and other apparatus are placed. As the central station in Rome is operated at a pressure of 2,000 volts, and as the Tivoli plant, as stated above, is intended as a supplementary station for the plant in Rome, the current from the Tivoli station must necessarily be reduced from 4,000 to 2,000 volts. For this purpose 32 transformers, each of 25,000 watts capacity, are placed in the transformer building. Of these 32 transformers, 16 arranged in parallel form a group which transforms the 4,000 volt current into a current at 2,000 volts, and transfers the current from the Tivoli aerial conductors to the underground network of concentric cables that distribute it over the streets of Rome. In the summer, when the demand is at a minimum, and also during the daytime at other seasons of the year, it is intended to operate entirely from the Tivoli plant, and to make use of the Rome central station only when greater demand makes it necessary.

At present 250 arc lights are in use, but this number can be increased at any time to 600. These lights are in series of 45 each, and have aerial lines of copper wire 4 millimeters in diameter. The use of aerial lines was necessary, from the fact that the lamps are widely distributed over the city, quite a number being at a considerable distance from the underground network of cables.

Each of the large transformers in the transformer house is able to furnish 14 amperes at 2,000 volts for supplying 45 arc lamps; 14 such transformers are able to feed the 14 arc light circuits, or over 600 lamps, the other two transformers being kept in reserve. In each of these circuits an automatic rheostat keeps the intensity of the current constant at 14 amperes.



INTERIOR VIEW OF THE TIVOLI CENTRAL STATION.

The entire outfit of the central station and of the transformer house, as well as the arc lamps, was furnished by Ganz & Co., of Budapest. The conductors and their supports were furnished by the Society Anglo-Romana, according to the specifications furnished under the direction of Ganz & Co. The entire plant is modeled on the Zipernowsky-Deri-Blathy system, and represents one of the most advanced types of European practice in the distribution of alternating currents over long distances for lighting and power purposes. It is interesting to know that this plant was planned as far back as 1888, a time when the application of a 5,000 volt current for any purpose was considered very remarkable.—*Electrical World.*

© 1892 SCIENTIFIC AMERICAN, INC.

Glycerine in Wine.

The usual method of determining glycerine in wine is that officially recognized by the Berlin committee of 1884, although it is far from ideal. The residue which is obtained by evaporating the wine together with quartz sand and milk of lime nearly to dryness is difficult to remove from the dish in which the evaporation has been performed, and a certain quantity of glycerine is apt to be left in the residue after extraction. The following are the modifications proposed by the author: 10 c. c. of the wine are well mixed with 0·1 of a gramme of powdered calcium hydrate, 10 grammes of quartz sand added, and the whole evaporated almost to dryness on the water bath. The residue is extracted four or five times with hot absolute alcohol, and the extract, amounting to 40–50 c. c., is filtered into a flask holding about 100 c. c., then evaporated on the water bath, sirupy residue dissolved in 5 c. c. of alcohol, 7·5 c. c. of ether added, the flask well corked, allowed to stand some hours, and the clear solution poured into a weighed flask (previously filtering if necessary), the alcoholic liquid evaporated off, and the residue dried for one hour in the water oven and weighed. This method, when tried on seven samples of Servian wine, containing from 0·7 to 1·0 per cent of glycerine, gave results ranging from 0·1 to 0·36 per cent higher than the old method; while, at the same time, closely concordant results were obtained by repetitions of the new method, and also when it was carried out on a scale ten times as great as that prescribed above. In order to ascertain whether the compound formed of lime and glycerine by evaporation to complete dryness resisted the solvent action of the alcohol, further experiments were made in which this condition obtained, with the result that the percentage of glycerine found was not diminished, but slightly increased. Should this observation be confirmed, the need for special precaution in the evaporation will be obviated. The author also states that he has obtained good results by evaporating an aliquot portion of the alcoholic extract, by which means previous filtration and washing necessary to the original process are avoided. He has yet to prove the purity of the glycerine thus isolated.—*M. T. Lecco, in Chem. Zeit.*

REYNAUD'S OPTICAL THEATER.

We have several times spoken of the apparatus constructed by Mr. Reynaud with the object of improving the methods of projections and that permit of obtaining the illusion of movement and life through optical processes.

The apparatus that produce the synthesis of the successive phases of an action have, up to the present, all (from Plateau's phenakistiscope to Reynaud's praxinoscope) been limited by their very nature to the reproduction of a motion or, at the most, of a very simple action, every rotation of the apparatus evidently being capable only of repeating the effect produced by the preceding rotation.

The object of the optical theater is to extend the illusion to the reproduction of a large series of actions, and of thus realizing the reconstruction of an entire scene through optical synthesis.

To this effect a band of great length carrying a large number of poses replaces the crown of the old apparatus. In order to present the animated scenic illusion to a great number of spectators, it was necessary to give it large dimensions, which is something that can be done only by projection upon a screen.

But, in order to obtain such illusion under good conditions for the operators, it is necessary that the postures shall succeed each other on the screen without a break; in other words, that there shall be no extinction or eclipse between two successive postures.

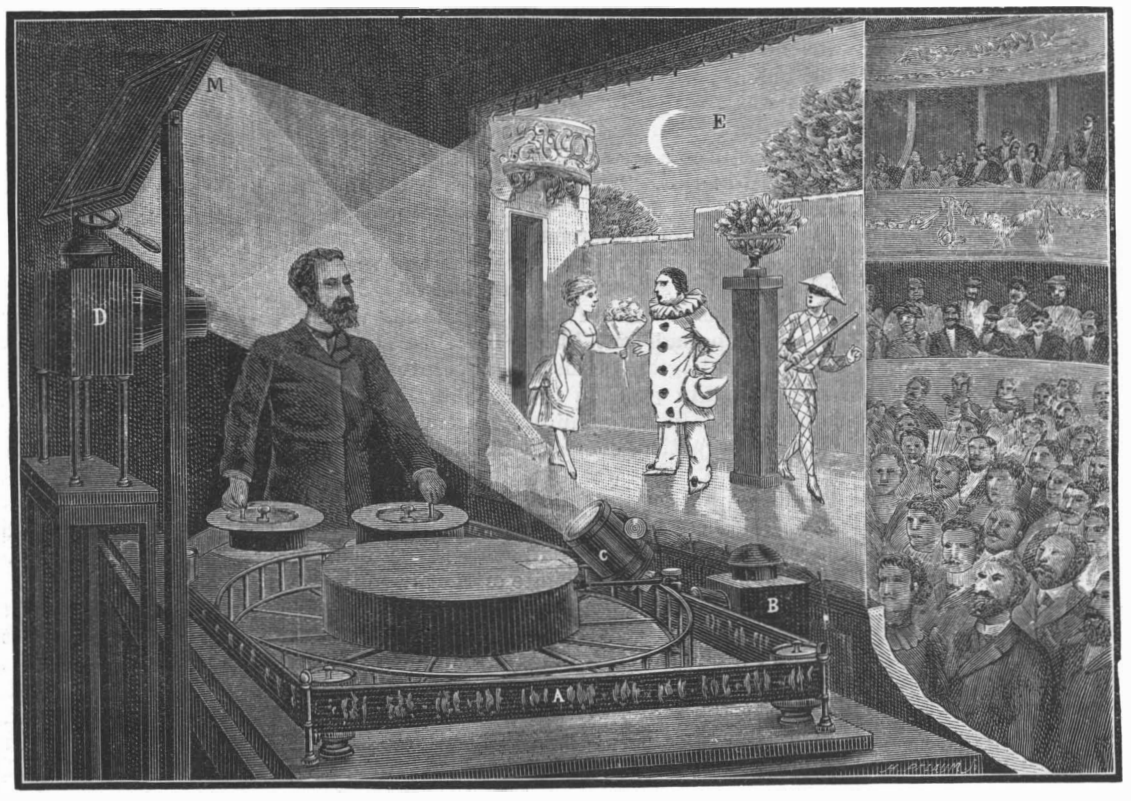
This continuity of the image, obtained already by the praxinoscope, invented in 1877 by Mr. Reynaud, has not, up to the present, been realized by any projecting apparatus.

The optical theater, by its very construction, realizes it in such a way that the succession of the postures may be interrupted at every instant without the image ceasing to be illuminated and visible upon the screen. This property permits, in the representation of the animated stage, of reposes and repetitions which, at the same time, increase the truthfulness of the effect and the duration of the scene represented. The optical theater thus allows spectators to witness complete scenes (pantomimes, interludes, etc.), lasting from 15 to 20 minutes, with a number of postures and a length of band that remain within practical limits. It thus produces a spectacle both interesting and amusing.

Moreover, the optical theater seems as if it will hereafter constitute the typical apparatus for the synthesis of the photographic series of successive postures, and it is doubtless in this direction that it will in the future find its principal application, when the improvements in instantaneous apparatus and the reduction in the cost price of photogenic films will have permitted of easily and cheaply obtaining very numerous series of such postures.

Our illustration represents the arrangement of Mr. Reynaud's new optical theater. The crystalloid band upon which the images are painted is represented at A. The operator can revolve it in one direction or the other by means of two handles. The images, reproduced by a special process of reproduction in colors, pass before the lantern, B, and are projected through the intermedium of a lens, C, upon an inclined mirror, M, which projects them upon the transparent screen, E. Another projection lantern, D, causes the appearance upon the stage of the scenery amid which appear the characters changing postures painted upon the band, A.

Mr. Reynaud has got up some very amusing scenes, especially the three-character pantomime entitled "*Pauvre Pierrot.*"—*La Nature.*



REYNAUD'S OPTICAL THEATER.

The New York State Canal Convention.

It is proposed to hold a convention this fall for the purpose of promoting the improvement of the canals of the State of New York. In paralleling the through railroad routes from Lake Erie to tidewater the Erie Canal figures as the connecting link in a complete water service, covering all the great lakes. In this connection its enormous importance as a competitor for freights with the railroads cannot well be overestimated. The other canals perform similar service, and their value in keeping down the freight charges on railroads is of the utmost importance also. This is a service directly affecting the producer. Anything done to promote the efficiency of the canals is a service to the farmer and lumberman, as well as to the consumer of their products. It is even claimed that New York would have never attained her relative importance among the States but for the canals.

From 1871 to 1891 the total tonnage of the New York canals was 106,844,759 tons, whose value is estimated at over three thousand millions of dollars. During the year 1891, one-third of all the grain brought to this port came through the canals.

It should be enough to remember that railroad rates are pool rates; that in 1891, on the opening of the Erie Canal, in May, the railroad rate for grain was 7½ cents per bushel, when the canal at once offered transportation for less than one-half this figure, 2⅝ to 3 cents a bushel. These figures show the value of the Erie Canal.

Again, when the canals are opened, New York receives nearly double the quantity of grain that Philadelphia, Baltimore and Boston combined can show. When the canals close, the New York receipts drop off to about the same as those of the three ports mentioned. Canal navigation is closed for five months. During their seven months of operation their value to the port of New York is immeasurable.

What is needed now is the improvement of the canals. They need to be deepened, the locks should be enlarged, and everything possible done to increase their efficiency. The present tendency seems to be to let them alone. This policy will be a very bad one for the port of New York.

The affairs of the convention are in the hands of the Union for the Improvement of the Canals of the State of New York, 55 Liberty Street, New York, N. Y. It is to be hoped that the ends in view will be speedily attained.

Laxative Lemonade.

The *Pharmaceutical Record* says that a preparation known as laxative lemonade is prepared in Germany by dissolving 30 to 50 grammes tartrate of soda in 500 grammes of hot water, allowing the solution to cool, and adding to it 50 to 100 grammes of flavored simple sirup. This mixture is then transferred to strong glass bottles and charged with the weight of several atmospheres of carbonic acid gas. This is said to furnish a cheap and effective substitute for citrate of magnesia.

© 1892 SCIENTIFIC AMERICAN, INC.

Correspondence.

Preservation of Hard Wood Handles.

To the Editor of the Scientific American:

I handle a great many hard wood handles for hammers, axes, etc., and I find that I lose a great many annually from the ravages of a little insect or wood borer, which thoroughly honeycombs a handle in a very short space of time, leaving the handle a mere shell with innumerable small holes on the outside, and grinding the inside into a powder as fine as flour. I have found it a very difficult matter to find specimens of this insect. The few that we have examined with a magnifying glass are smaller than a flea and of a milk white color, with long antennæ, although one was discovered considerably larger, about the size of a flea, and dark colored, but was the only one. I would like to ask you, 1st, the scientific name and common name of the insect; 2d, a remedy, if there is any, to prevent the destructive work of this little pest.

Los Angeles, Sept. 7, 1892. C. DUCOMMUN.

Dr. C. V. Riley, to whom we referred our correspondent's letter for reply, writes as follows:

1. There are several coleopterous insects of the family *Ptinidæ* known to infest dry hard wood that is used for handles of various implements. Since Mr. Ducommun does not send any specimens, it is impossible to name the particular species which does the damage. It is, however, in all probability, one of the powder post beetles, genus *Lyctus*, of which *L. striatulus* and *L. parallelopipedus* have been observed under conditions similar to those described by Mr. Ducommun. They are small, elongate brownish beetles, and their larvæ small, six-legged yellowish white grubs, with their bodies always curved near the tail end.

2. The beetles and their larvæ may be destroyed by immersing the infested handles in kerosene for a short time. It is quite important, however, to thoroughly disinfect in this manner all handles which show the least trace of the presence of the beetle. The entire stock of handles kept in the store should be carefully inspected from time to time. The presence of the beetles may be easily detected from the small circular holes through which the beetles have entered the wood, or from the little heaps of fine sawdust which accumulate beneath the infested handles.

The Electric Cars in Boston.

To the Editor of the Scientific American:

I have been a constant reader of your paper for over thirty years, and have never yet discovered what I thought to be an article published with a view to promote any unworthy scheme, or misrepresenting facts for the benefit of any individual or corporation.

There appears, however, in your issue of September 17 an article headed "The Trolley Electric Car," which was copied from an electrical paper, and in which the trolley system of Boston is very highly spoken of. The article speaks of the "great success" and the "enormous profits" realized by the system in Boston, and refers to the sale of the company's stock as proof of the fact. The facts in the case are that electric cars have been the greatest nuisance that was ever put into the streets of Boston. So far as improving the surface travel of the city, it has impeded it very much, and the accommodations are not as good as the former horse car service, except to parties who are riding to the suburbs or country. In the center and more immediate circles of business and travel it has blockaded our streets, with great hazard to life and property. It is impossible to calculate with any degree of accuracy when you can reach a certain point; something happens, the trolley is out of order, the fuse is burned out, or the car is off the track; so that we often find a mile of heavy cars in line, with not enough power on a single trolley wire to move but a few at a time.

Horses and men have been killed and injured by falling trolley wires, and one of the worst fires in Boston, where three or four million dollars' worth of property and several lives were lost, was set by an electric wire, which was supposed to have come in contact with the trolley system.

The telephone system has been greatly impaired by the trolley wires, and accidents have been fearful. From the last official report of the railroad commissioners, for one year, it appears there were 281 accidents, resulting in 20 deaths. The amount of damages paid by the railroad company for the last fiscal year was $149,592.42, with, perhaps, full as many more unsettled claims—an average of $407 for each day in the year. It is believed by those most familiar with the receipts and expenditures of this company, with their accident account, cost of repairs, increased capitalization, etc., that they can never earn a dividend.

The capital stock, etc., of this company has been increased from $6,400,000 to $16,400,000, with debts and liabilities amounting to $20,000,000, in four years. Although they have paid eight and ten per cent dividends on their common and preferred stock, which, of course, has carried their stock somewhat above par, yet, when you consider that in Massachusetts dividends can be paid out of capital stock or borrowed money, it is easy to see how stocks can be sold above par.

Outside of those who live a long distance from the center of the city, and get cheap fares and extra speed in the suburbs, and those who have personal interest at stake, I think the electric road would be voted out of Boston. I have no personal or private interest in this or any other company, but am simply a careful observer, with some knowledge of the cost and profits of street railway traffic. J. V. M.

Boston, September, 1892.

High Speed Photography.

Professor C. V. Boys recently gave a British Association lecture to artisans at the Synod Hall, Edinburgh, at which Lord McLaren presided.

Professor Boys explained that in the observation of moving things a so-called instantaneous view is necessary, but that, according to the nature of the subject, different degrees of instantaneity are sufficient or necessary. Thus for portraiture the magnesium flash is so sudden that an eye with the pupil wide open, as it is in the dark, has not time to contract during the time that the light lasts: while, on the other hand, a large clock face made to rotate so fast that the outside of it was traveling at forty miles an hour appeared a mere blur by this light.

In contrast to this the same rotating clock face was illuminated by a brilliant electric spark, and appeared absolutely at rest, the finest marks being clear and sharp. Therefore, in dealing with such slow speeds as forty or one hundred miles an hour, the particular electric spark made use of would last a sufficiently short time. In illustration of the application of an ordinary electric spark to the photography of bodies moving at speeds less than sixty miles an hour, Mr. F. J. Smith's experiments with intermittent sparks were referred to, and one of Lord Rayleigh's photographs of a breaking bubble was exhibited.

In illustration of the perfection to which mechanical methods may be brought, a very perfect photograph of a broad gauge express train, which passed Mr. F. J. Smith at one hundred miles an hour, was exhibited. The camera was in a train traveling at forty miles an hour, and the other train was meeting it at sixty miles an hour. The lecturer had to deal with speeds which were very much greater, so that it was by no means evident that the spark, which to such tests seemed perfectly instantaneous, lasted in reality so short a time that a bullet, for instance, would not move a visible amount before the light had ceased.

In order to investigate the duration of sparks made under different circumstances, the revolving mirror had been employed, and the method of using it was shown. It was placed about twenty feet from the screen, where a beam of light from an electric lamp was focused. If the mirror were made to turn once a second, the image was shown to travel at the rate of 240 feet a second on the screen. The electro-magnetic driving apparatus was then allowed to rotate until the mirror was turning 1,000 times a second, when the image traveled on the screen 240,000 feet a second, or about 160,000 miles an hour—nearly 200 times as fast as the bullet from a Martini-Henry rifle, the bullet traveling only thirteen times as fast as an express train.

It was thus possible to observe easily to the 1-100,000,000th of a second how long any spark actually lasted. Photographs of three sparks taken with the apparatus were exhibited, showing that such a spark as that which had just seemed to be instantaneous really lasted as much as the 1-100,000th of a second, which was far too long for the purpose of photographing rifle bullets; whereas a spark made with other apparatus was practically extinct in 1-10,000,000th of a second, and the last light died away in less than 1-1,000,000th of a second. The third spark lasted less than half of this. The second spark is the one which the lecturer had employed in his experiments.

Professor Boys then referred to the experiments of Professor Mach, of Prague, who was the first to photograph bullets successfully, and showed a diagram of his apparatus and one of the photographs which Professor Mach had sent him. He then showed and explained a diagram of his own apparatus, and a photograph of it in position in the laboratory. The apparatus itself, to the uninitiated, seeming to be of the rudest construction, consisted in the main of a rough packing case, but it was in reality more carefully designed than was apparent.

This had been brought and set up in a position as for taking a photograph, but, as was explained, owing to the moisture-saturated state of the air in the room, the glass plate could not be properly electrified. However, a bullet was sent through it from a magazine rifle on the chance that the spark would pass, and if it had, the plate would have been developed and shown in the lantern. A series of photographs of bullets, shot, and so on, taken in the last few weeks, were then exhibited, and their features explained.

A pistol bullet (750 feet a second) was the first one shown. This and the wad were clear and sharp, but no atmospheric waves were visible. A Martini-Henry rifle bullet (1,295 feet a second) was perfectly defined, and waves similar to those seen on water through the still surface of which a point is dragged were clearly defined. A magazine rifle bullet (2,000 feet a second) left a conspicuous trail like that behind a steamer, and the head and tail waves were more conspicuous than those last seen, and were more inclined to the perpendicular. The connection between the speed and the inclination of the waves, both in the case of water waves and air waves, was shortly explained, and it was shown that when the body is moving at a speed which is less than a particular speed, in each case none are found.

In illustration of this point, an aluminum bullet of 3,000 feet a second showed still more inclined waves, while the inclination was greater still in another photograph when the bullet had been fired through a mixture of carbonic acid gas and ether vapors, in which sound—that is waves—can only travel at about half the speed that it does in air.

Mr. Scott Russell's experiments on the reflection of water waves, published in the journal of the British Association of 1844, were then referred to, and it was shown that air waves may behave in precisely the same manner, being either perfectly reflected or wholly unreflected, in which case they gather strength and form a breaker, and that this depended on the inclination. Thus at a grazing incidence there is no reflection. This is the case of the whispering gallery. The lecturer also showed that the deflection of bullets near walls was likely to be less in the case of high speeds, for then the air wave, being more inclined, would be reflected instead of running ahead and increasing the resistance on one side of the bullet, as photographs showed was the case.

Three photographs of shot, fired from an ordinary fowling piece were next shown, the first from a choke-bore, the second from a cylindrical barrel, and the third from the same barrel, but with a few drops of oil among the shot. These were of interest in connection with the discussion as to the longitudinal and the lateral spreading of the shot. The last series of slides showed what happened when a bullet pierced a glass plate. A series of views were taken as it gradually went through and escaped from the cloud of glass it had created. It was shown that here again the air waves about the glass plate gave information as to what the glass had been doing from the moment of the first collision to the time—in one case, 1-100th second later—when the photograph was taken. The lecturer concluded by expressing his obligation to those who had helped him in the experiments.

Cobalt Toning.

M. Alexis Redares, in a communication to *La Photographie*, relates his experience in regard to cobalt toning. He says, in place of cobalt depositing itself on albumenized paper in a metallic state, it deposits brown oxide of cobalt, and the proofs obtained are of a reddish color, and leave much to be desired. He used the following solutions:

A.

Water	1,000 cm. 3
Chloride of cobalt	10 gr.

B.

Water	1,000 cm. 3
Acetate of lime	40 gr.

100 cm. 3 of A mixed with 130 cm. 3 of B, leaving this mixture three or four days before filtering. Test by sunflower paper to find if solution is acid or basic. If acid, add drops of a 10 per cent solution of bicarbonate of lime. If basic, saturate with a 10 per cent solution of hydrochloric acid. The bath should be absolutely neuter, otherwise it will not tone. From two to three days are required to tone by this process on ordinary paper. Fix with hyposulphite as usual.

M. Redares has used in the bath acetate of lime in place of acetate of soda, which he finds has no reducing power on the salts of cobalt. He expresses hopes of perfecting the cobalt toning, and regrets he cannot yet give a formula which will tone in a couple of hours.

Apyrite, a New Smokeless Powder.

Although full information of the composition of this powder is not obtainable, it is known that nitro-cellulose enters largely into it. It is claimed that this powders burns without flame or smoke, that it can be handled and transported without danger, and that it is not affected by moisture or heat. According to the *Revue Scientifique* experiments recently made at Stockholm showed that twenty shots with apyrite did not heat the gun as much as fifteen shots with ordinary Swedish powder, or ten shots of nitro-glycerine powder. Neither does it foul the gun, 800 shots with it leaving the gun clean. The same authority states that with the new magazine gun used in Sweden, 3·5 grammes, or about one-eighth of an ounce, will give an initial velocity of 640 meters, or 2,080 feet, with a pressure of 2,260 atmospheres. The manufacture of this powder requires, it is said, neither special appliances nor buildings.

© 1892 SCIENTIFIC AMERICAN, INC.

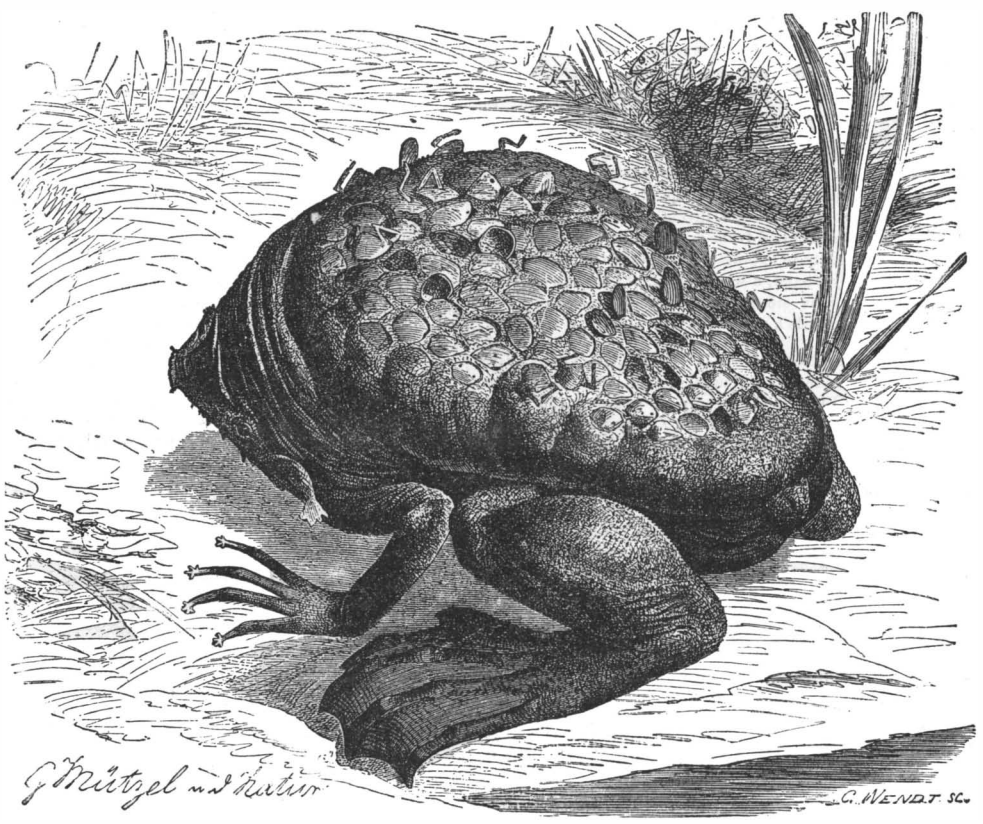
Electrolytic Process for Antimony.

According to the *Moniteur Scientifique*, Koepp, of Rheingau, Austria, has invented the following process for obtaining antimony from its ores. It consists in treating sulphide of antimony with certain salts of oxide of iron alone or in connection with haloid salts in an apparatus from which the antimony is deposited electrolytically. The trisulphide of antimony is decomposed in contact with ferric salts, sulphur is liberated, and the ferric oxide passes to the state of ferrous oxide, and at the same time antimonious oxide passes into solution. The reaction is rapid, and is complete when it takes place in the presence of free hydrochloric acid, or, better, in the presence of a haloid salt, such as common salt. The following reaction is explanatory: $2Fe_2Cl_6 + Sb_2S_3 = 2Fe_2Cl_4 + Sb_2Cl_4 + S_3$. The antimonial solution freed from the sulphur by filtration is submitted to electrolytic action, and the antimony is precipitated at the negative pole, the iron being oxidized at the positive pole, giving a solution of ferric chloride which can be used for the treatment of fresh quantities of sulphides of antimony. The anode and cathode are composed of lead plate. The bath is heated to about 50° and maintained in constant movement. In order to obtain a compact deposit of antimony, it is necessary to employ a current of 40 amperes or thereabout for each square meter of surface of the cathode.

THE PIPA AMERICANA.

This animal raises its young in a very peculiar manner. The male pipa places the eggs on the back of the female, where they are held by a secretion from the skin until each one is inclosed in a little hexagonal case shaped like the cells of the honeycomb, and developed in the skin of the mother frog. Each casing is closed by a little cover. In these little cases the sixty or seventy young of every pipa pass the eighty-two days which constitute their period of development.

The engraving is copied by the *Illustrirte Zeitung* from the seventh volume of Brehm's "Thierleben," which has lately been completely revised by Dr. Böttger.



THE PIPA AMERICANA. (ONE HALF NATURAL SIZE.)

The Washington and Georgetown New Cable Plant.

The Washington and Georgetown Street Railway Company has just equipped the Pennsylvania avenue and Fourteenth street branches of its road with a new cable plant at a cost of $3,000,000. This, together with the Seventh street road owned by this company, and already using the cable system, makes the most complete and one of the largest cable systems in the country. The company's tracks cross the entire length of the city, from east to west, over Pennsylvania avenue, and across the width of town, north and south, by double tracks on Seventh and Fourteenth streets. The entire system contains twenty-two miles of single track, all Johnson's girder rail, eighty pounds to the yard. The track gauge is 4 feet 8½ inches, and the maximum grade is 6 per cent, occurring on a stretch of about 1,000 feet, on what is known as Capitol Hill. The entire system has a capacity of four hundred cars, but only two hundred and ten in regular daily use.

The power house of the new plant is at Fourteenth and D streets, N. W. It is in the center of the business section of town, and the site, which is 141×241 feet in extent, cost alone $556,000. The ground, however, was insecure, which necessitated the sinking of two thousand one hundred piles, from 25 to 30 feet long, on which the masonry foundation was laid. The building, while plain in outline, is a handsome structure of selected red pressed brick, with red Seneca sandstone trimmings. It covers the whole of the square of ground bought by the company. It has a height of 98 feet in three stories. The ground floor and a part of the second floor will be occupied by the company for the cable plant and offices, and the remainder will be let for offices and manufacturing purposes.

The engines of the new plant are of the Reynolds-Corliss type, and are furnished by the Edward P. Allis Company, of Milwaukee. They are 36×72 inches cylinders, and 750 nominal horse power. The fly wheel is 30 feet in diameter, and weighs 100,000 pounds, and has a normal speed of fifty revolutions per minute. The 15 inch line shaft is 66 feet between the engines. Steam is furnished to the engines from a battery of eight Babcock & Wilcox boilers, of 184 horse power each. The fuel is fed to the furnace by the Rooney mechanical stokers, and the ashes are disposed of in the same way. The Berryman feed water heater is used, and all the steam connections of the building are by Blake & Williams, of New York. The driving plant was furnished by Robert Poole & Son Company, Baltimore.

Three cables are operated from the house, one known as the West avenue section, containing 23,760 feet, the Fourteenth street section, containing 27,900 feet, and the East avenue section of 31,660 feet. An auxiliary cable of 4,000 feet carries a line of cars from the main line of the road, at the foot of the Capitol, to the Baltimore and Ohio depot, by an ingenious device, the design of Mr. Upton, chief engineer of the road, and it is as simple as it is ingenious. It is practically a small driving plant on the plan of those at the power house, but minus the engine. The East avenue cable, on its way to the navy yard, is passed by a turn round the drum of this secondary driving plant, which is sunk in a vault 14 feet deep, beneath the pavement, and in this way the 4,000 feet of auxiliary cable is kept going at a rate of six miles per hour, without interfering with the rest of the line.

Besides the power house, in the center of the city, there are two new car barns, one at Mount Pleasant, the terminus of the Fourteenth street road, J. L. Parsons, Washington, D. C., contractor, and the other at the navy yard, the eastern terminus of the Pennsylvania avenue line, S. H. & J. F. Adams, Baltimore, contractors. Both these buildings are of pressed brick, with red sandstone trimmings, and are quite an ornament to the neighborhood.

The road was designed by W. B. Upton, chief engineer of the road, in consultation with Daniel Bontecou, of Kansas City, consulting engineer, and the construction was carried out under the supervision of D. S. Carll, erecting engineer.

The driving plants for the three cables at the power house are entirely independent, and by means of friction clutches any cable may be operated by either of the engines without regard to the others. The total length of the 15 inch drum shafting is 95 feet. The cable drums are 14 feet in diameter, fitted with Walker differential rims, which, in the Seventh street power house, have given wonderful service, and after two years' wear were measured but a short time ago, and failed to show a wear of $\frac{1}{32}$ of an inch. The cable drums are of six grooves each, and are both operated by a rope drive, an entirely new departure in cable construction. The pulleys on the line shaft are 9 feet 8½ inches and those on the drum shaft are 26. On the West avenue and Fourteenth street sections the line shaft drums have seven and nine grooves in each set, but on the East avenue section, which is 3,760 feet longer than any of the others, the pulleys have twelve and fourteen grooves. The power is transmitted from the line shaft drum by "stevedore" manila ropes, to the 26 feet pulleys on the cable drum shaft. The cable is 1¼ inches, Lang lay, six pieces of nineteen strands each over a hemp core, and was made by the John A. Roebling Company.

The cable tension device is one of the most interesting features of the whole plant. It is the design of W. B. Upton, chief engineer of the road, and was designed especially with a view to remedy the surging of the cars by means of an automatic variation of the tension. It was tried on the Seventh street road for several months with entire success, and all three of the cables in the new power house are fitted with it. The tension carriage is also Mr. Upton's design.

The principle of the device is a weight, suspended between lever arms, in such a way as to bring the tension heavier or lighter on the levers, as the tension is heavier or lighter on the cable.

The cable speed will be nine miles per hour.

Work on the road was begun in May of 1891, and finished in July, 1892, but the construction was not pushed during the whole time.

The cars are operated with a grip and single trailer, or with two trailers in the crowded hours of the day. The seventy grip cars were manufactured by the John Stephenson Company. They are 14 feet long, and have a seating capacity of twenty. The one hundred and eighty passenger cars are from the American Car Company, St. Louis. The closed cars have a seating capacity of thirty-two, and the open cars will carry forty. Cars are switched at the ends of the line, no turntables being used.

The power house was designed by W. C. Root, of Kansas City, and was placed in the hands of J. E. & A. L. Pennock, contractors, of Philadelphia. All of the architectural iron work was furnished by the Champion Iron Company, of Ohio. The work was greatly delayed by the insecure ground, which necessitated the sinking of piles for the masonry foundation, and by bad weather during the winter, which hindered the brick workers.

The Washington and Georgetown Street Railway Company was organized in May of 1862, using a very poor quality of horse power on bob-tailed cars. It has grown constantly with the growth of the city, its improvements keeping well abreast of the times, in spite of occasional adverse Congressional criticisms to the contrary. The Congressional provision for the change in motive power was made just two years ago from the 6th of the present month, and was a very short time for the accomplishment of such an undertaking; but, by constant, steady work, the change was made and the first car was run over the line on the last day of the two years time limit allowed by Congress. The present officers of the road are Henry Hurt, president; C. M. Koomes, secretary and treasurer; and C. C. Sailer, superintendent. —*Street Railway Review.*

California Beer Seed.

A correspondent sends a small package containing some "California beer seed." He says: "It is used with sugar and water for making domestic beer. This sample was dried the present summer. When in its best condition it causes a brisk alcoholic fermentation, about the same as common yeast. This may not be as active as the best, but it is the freshest I can procure now, and is enough for a pint of water, with 1½ ounces of sugar dissolved in it and kept at a proper temperature for alcoholic fermentation. The beer that this came from was made with sorghum molasses, from which it derived its dark color. In its normal purity and wet it is perfectly white. It is self-propagating, that is, it increases in quantity while fermenting sweetened water."

Answer by Dr. C. V. Riley.—I have had this substance before and have watched the interesting fermentation of water and sugar under its influence. The action is due to a bacterium and a fungus the species of which in our American substance have not, as Prof. Galloway, the micologist of the department, informs me, been settled definitely. It is similar, if not identical, to the so-called "ginger beer plant" of Europe, and in this case Marshall Ward, in the Proceedings of the Royal Society, Volume L., No. 304, London, 1891, determines the organisms involved as *Bacterium vermiforme* and *Saccharomyces pyriformis*. Mr. Charles L. Mix, in the Proceedings of the American Academy of Arts and Sciences, Volume XXVI., speaks of this subject under the following title: "On a Kephir-like Yeast found in the United States." He summarizes the European literature concerning the milk ferment of the Caucasus, and concludes that the American ferment is almost if not quite identical with the European kephir, in which the bacterium is *Dispora caucasica*, and the fungus is *Saccharomyces cerevisiae*. Beyerinck, in the "Centralblatt fur Bakteriologie," Volume VI., p. 44, describes the *Saccharomyces* as a new species, making it distinct from *cerevisiae* and giving it the name of *kefyr*. This name Mix adopts for the American fungus, although this adoption seems to be provisional. For the present we can do no better than to accept Mix's conclusions.

© 1892 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Freeman Thompson, Dover, N. H. This invention provides a device by which cars may be automatically coupled together so that they cannot become accidentally uncoupled, the coupling being conveniently and safely operated from the top or the sides of the car. The invention covers a novel construction and combination of parts; the device may, if necessary, be coupled to an old-fashioned coupling, using the ordinary link and pin.

CAR COUPLING.—George W. Wilkinson, Chicago, Ill. This invention relates to devices having a movable knuckle and hooking with one another when coupling. The drawheads or couplers of adjacent cars alike have the hook form to engage with another, and occupy a horizontal position; each is composed of two parts, a stationary, partly hook-shaped head integral with the drawbar, and a movable or sliding hook-shaped knuckle of arc shape working through a corresponding hook-shaped slot in the fixed head part. This knuckle part, and a lever which engages and releases it, are the only two movable parts of each coupler.

RAILWAY TIME SIGNAL.—Walter Scott, Hot Springs, South Dakota. A time clock is provided by this inventor with a stopping mechanism for an auxiliary clock adapted to be released by an electro-magnet releasing mechanism of special construction, forming a time signal of simple and durable construction, very effective and automatic in operation, and arranged to positively and accurately record the time when the train passes the track on which the device is applied.

FOLDING STEP FOR CAR BERTHS.—Harry C. Stanley, New York City. A light, strong ladder is, according to this invention, made to fold into the form of an elongated bar, that is loosely secured to an upper berth of a car or steamer, being located in a slot in the front rail of the berth, so that when swung laterally out it will assume the form of a step ladder, reaching to the floor, thus affording convenient means of reaching the upper berths.

MOVABLE STEP.—Frank Forster, Etiwanda, Cal. This is a simple form of step, adapted to be easily secured to the usual steps of a car, where it may be readily operated to drop beneath the lower stationary step, while it may be conveniently pushed up and held out of the way when not in use, so that there will be no danger of its coming in contact with any obstruction on the road.

TANK FEEDER.—Merritt Burt and John W. Skilton, Jacksonville, Fla. This is an invention especially applicable for use along railroad lines, or it may be employed for other purposes. Into a well or other water reservoir extends a pipe open at its lower end, near which are lateral openings for the ingress of water, while just above the water level is an air inlet, there being at the upper end of the pipe a discharge spout leading into the tank. A valved piston is fitted to work in the pipe, descending by gravity, and being lifted by a wire rope passing over a drum and connected with a locomotive or a lifting mechanism, the piston on its upward movement lifting and discharging into the tank the body of water in the pipe above it.

Mechanical.

HOLLOW MANDREL CHUCK.—Frederick A. Buck, Urbana, O. This is a chuck more especially intended for holding broom and like handles while the broom material is being tied, though also applicable for other purposes. Its main feature is a loose arrangement of the dies, which will turn in the cone whenever the handle held by the dies offers sufficient resistance, when, as the pressure at both ends overcomes the friction, all will turn together. The handles are thus firmly grasped while being revolved to secure the broom material on them, without that marring likely to occur when employing stationary dies in the hollow mandrel to hold the handles.

DEVICE FOR CONVERTING MOTION.—George E. Morrison and William A. Dye, Jr., Edgerton, Kansas. This is a device for converting rotary into reciprocating motion, especially where the reciprocating parts are not intended to move rapidly, being designed for use in connection with vibrating sieves and shake-feeds of roller mills, and with the shakers of wheat separators, middlings purifiers, sieve scalpers, thrashing machines, etc. It consists of a revoluble cam wheel and rollers journaled on a movable body on opposite sides of the cam wheel to press against it, one of the rollers having a sliding bearing and a spring for holding it against the cam wheel.

Agricultural.

PLOW FENDER.—Gaston N. Spencer, Ouachita City, La. This fender is readily applied to an ordinary plow or other implement used for cultivating between rows of growing plants, and has spring fingers to catch the heavy clods and large pieces which might be thrown upon and injure the plants, while causing the dirt to be partially sifted, so that only fine dirt and the requisite quantity will be thrown around the roots of the plants.

PLOW ATTACHMENT.—Curtis H. Warrington, West Chester, Pa. This is a device for preventing the share and mould board from becoming clogged with weeds and rubbish, the attachment being applicable to either right hand or left hand plows. A traction wheel journaled in a yoke frame adjustably attached to the front end of the plow beam actuates a bevel gear by which are operated sprocket wheels, carrying an endless chain belt and carriers, by means of which, as the plow is advanced, any trash in the path of its share is taken up and delivered into the furrow, where it will be covered up by the overturning earth.

Miscellaneous.

ICE MACHINE.—Magnus J. Palson, Gloucester, Mass. This invention relates to absorption ice machines, in which aqua ammonia is treated to form anhydrous ammonia gas, which is condensed and then expanded into gaseous form in a refrigerator, the gas afterward being absorbed by weak ammonia liquor from the still, and the aqua ammonia thus formed being again utilized to produce ammonia gas, the process being continuous. The invention covers several features of the apparatus, which is designed to utilize to the highest degree the heat generated, the resultant economy being gauged by the proportion which the ice made bears to the fuel consumed.

ORE WASHING MACHINES.—Carl A. E. Meinicke, Clausthal, Germany. A device for regularly feeding a quantity of pulp to the machine is provided by this invention, the improvement consisting principally of a knife adapted to cut on the surface of the material held in a vessel or a tank, in conjunction with which is arranged a watering device to dissolve and wash away the material cut by the knife.

OIL EXTRACTING APPARATUS.—Charles Mann, New York City. This improvement includes a steam-jacketed extracting tank with a strainer in its bottom and a rotary stirrer, connected at its bottom with the top of a steam-jacketed evaporator at a lower level, there being a centrifugal spraying mechanism in the evaporator, from the top of which a vapor pipe leads into the top of the extractor, so that the vaporized extracting fluid will be conducted back to the extractor. The apparatus is adapted for use in extracting oil from cotton seed, linseed, and similar substances, at the same time deodorizing the oil.

OIL PURIFIER AND RESERVOIR.—Rudolph Metz, Philadelphia, Pa. The main tank of this combination device has a lower water inlet and outlet, a central well with outlets near the top, a hopper above the well having an outlet tube extending down into the well, in the lower portion of which is a steam coil, while hoppers, arranged beneath the well outlets, have delivery tubes extending into the lower portion of the tank. The oil accumulating in waste material, etc., may by this device be easily strained and filtered, the dirty oil being boiled in a separate receptacle from that in which it is finally stored.

PUMP.—William Peterson, Genesee, Minn. A pump especially adapted for use in tubular wells is provided by this invention, the pump having two pistons actuated from a single lever reciprocated simultaneously in opposite directions, the lever being operated by a hand, a wind wheel, or other power. The construction is simple, durable, and inexpensive, and the pump affords a continuous stream.

STEAMING OR TEMPERING GRAIN.—Rollin L. Rodman, Kingman, Kansas. This device is so constructed that if the supply of grain to the grinding machine or bin should be stopped, the supply of steam and material will both be automatically cut off, and when the supply is continued the grain and steam will both be admitted automatically. Within a suitable casing is a counterbalanced hopper, in which is a zigzag passageway or chute with steam inlets and a valve beneath the grain supply opening, there being another valved steam supply pipe and connection between the valves at the grain supply opening, whereby the movement of the hopper operates the valves.

TILTING DEVICE FOR BARRELS OR CASKS.—William Fullard, Brooklyn, N. Y. Combined with the barrel rack or stand is a transverse centrally-pivoted vertically and transversely tilting pillow block, with a spring mechanism for forcing the block upward. The device is simple, thoroughly automatic, and can be applied to any form of rack, its action being, as the liquid is drawn from the barrel, to raise the rear end of the barrel, so that the liquid always lies at the front end, near the faucet, permitting all the contents to be drawn.

WIRE STRETCHER.—Judson N. Hatcher, Montgomery, Mo. This invention is for an improvement in devices used for stretching fence wire, providing for the purpose a cheap, strong, and effective machine, which may be quickly fastened to a wire and easily operated to give the desired tension, while having no side draught, and enabling all the power used to be applied directly to the wire. The machine has a double ratchet bar, between the members of which moves the draw-bar, operated by a lever, there being pivoted on the draw-bar a wire clamp with a fixed jaw on one side and a cam lever pivoted adjacent to the jaw.

BALANCE STAFF BEARING FOR TIMEPIECES.—George Newton, New York City. This improvement provides a means whereby the pivots of the balance staffs of watches or chronometers, and the jewels, stones or bearings in which they work will be protected from breakage or injury when the watch or chronometer meets with a severe fall, shock, or blow. According to this invention the rings, beds, or bands in which the jewels, stones, or bearings are set are each mounted in the end of a reciprocating spring, so that they may recede or give way, to some extent, a peculiar form of balance staff being also employed, which is so adjusted as to take the shock from its pivots by coming in contact with the bridges.

GAS BURNER ATTACHMENT.—George Le Vesconte, Minneapolis, Minn. The burner is carried by the upper end of a vertical key, and a metallic band secured at one end to the gaspipe is curved upward over the burner and downward, there being operating connections between the lower end of the band and the key. The device is very simple and inexpensive, and operates to automatically turn off the gas when the gaslight is blown out by ignorance or accident.

LIGHTING DEVICE.—Bradford H. Pendleton, Evanston, Ill. By this device, lamps, lanterns, gas jets, etc., may be conveniently lighted without removing the chimney or globe, no matches being needed, and the device being ready at all times for immediate use. A small box, carrying a scratcher, is secured to extend from near the burner down and outwardly, and in a circular casing, pivoted in the box, is a strip arranged in a roll and pivoted with igniting points, a shaft turning in the box winding up the igniting strip. The shaft is rotated by turning a knob, by means of which the ignition points are successively brought against the scratcher to light the wick or jet.

BOOK INDEX.—William B. Devin, Syracuse, N. Y. This invention relates to an index attachment, especially designed for indexes to letter books, providing a device by which an index may be flexibly connected with one of the leaves of the book, independently of the back. The index is flexibly connected, so that when the book is closed the index may be drawn out to lie flat in front of it, the leaves of the index being then readily turned.

RUBBER DAM CLAMP.—Asher I. F. Buxbaum, Walnut Hills, O. This invention provides a dental cervix clamp having arms with teeth or spurs adapted to embrace a portion of the neck of the tooth, the arms being pivotally connected to the clamp and made adjustable. The clamp is used for pushing and holding back the gum and rubber dam from the neck of the tooth, to permit of the treatment of decay cavities, and is adapted to fit the neck of any sized tooth.

FLOUR SIFTER.—Ida M. Ingram, Sedalia, Mo. This sifter has a cylindrical body with a sieve in its bottom, a series of connected spaced sieves being passed downward into the body and removable collectively therefrom, while a central shaft extending down through the connected sieves has an agitator for each of them and one for the lower sieve. A crank handle turns the agitator shaft, and this sifter at one operation practically sifts the flour several times, thoroughly mixing it with baking powder and other ingredients when this is desired.

CUSHION FELLY AND TIRE.—Charles Stein, Meadville, Pa. This felly may be a tube, crushed to the desired shape, and is preferably of spring material, while it has side sockets and a central bent portion shaped to fit against the main part, in connection with a hollow tire having a concaved inner portion, and with shoulders to fit in the sockets of the felly. The cushion felly and tire together are designed to have a double spring action, thus rendering the wheel as easy as one provided with a pneumatic tire.

DRAUGHT DEVICE FOR WHIFFLETREES.—Quintis V. P. Day, Dinuba, Cal. This is a spring draught, designed to relieve the vehicle, harness, etc., of the jerk or jar of sudden starting, or from the vehicle striking a stone or other obstruction. The draught bar is arranged between springs located in a casing, lateral arms of the bar engaging the springs. The device is applicable to plows, etc., as well as to all kinds of vehicles drawn by horses.

HUB-ATTACHING DEVICE.—Michael F. Deininger, Brooklyn, N. Y. The hub box has a notch in its outer end, and a nut screwing into this end has a spring-pressed locking pin projecting through a flange into the notch, there being an operating finger piece to retract the pin. The device is simple and durable, and is more especially designed for securely locking the wheel nut in place, and conveniently unlocking it for removal when desired.

ROAD CART.—Jesse Kimball, New Madrid, Mo. The box of this vehicle is freely suspended on the running gear, which is carried by a shaft journaled beneath the box, crank arms secured to the shaft being connected with the box, in connection with a lever mechanism for turning and adjusting the crank shaft by which the body may be held so as to be properly balanced to enable it to ride nicely. A vehicle so built is especially adapted for rough roads, as the body is free to swing in any direction, and is designed to ride very easily.

VEHICLE RUNNING GEAR.—James W. Taylor, Vermillion, South Dakota. This is an improvement whereby the front and rear axles are conveniently and securely connected without undue strain on the king bolt or bolsters, the axles being strengthened and arranged to permit of removing a worn-out thimble to replace it by a new one. The axle is formed of two independent side plates having their ends rounded to form spindles, a top plate fitting on the side plates, thimbles being shrunk on the spindles and heads, while a flanged nut screws on the outer threaded end of each spindle to abut against the end of the thimble.

CASE CLEANER.—Peter Trips, Lebanon, Ind. This is a simple and inexpensive machine for cleaning the entrails of animals, to adapt them for sausage cases. The machine frame has horizontal grooves in its inner wall in which slides a cross bar to which a case may be attached, rollers causing the case to be drawn through the machine while brushes scrape off its fat and filth, and spring-pressed toothed scrapers clean the brushes.

BUCKSAW.—Peter Woodring, Kansas City, Mo. Combined with the side or end pieces of the frame are centrally interlapping and crossing diagonal braces having slots through which passes a clamping set screw, adjustable from the exterior of the braces, for operation in connection with an adjustable stretcher. The improvement is designed to give a more rigid support to the saw frame, preventing it from getting out of shape or becoming racked, and largely removing strain from the stretcher while using the saw.

STEAM MANGLE.—Frank Baldwin, New York City. A plurality of stationary horizontally aligned irons are mounted on the frame of this machine, with a space between their adjacent edges, and with their lower faces convex and forming segments of a common circle, there being means for heating the irons, and an endless belt carried by rollers running against the lower convex faces of the irons. The belt serves as a carrier and also as a compressing agent, maintaining the clothes in positive and close engagement with the convexed faces of the irons.

EXTENSION TABLE.—Henry Cobham, Jr., Warren, Pa. In connection with sliding rails the top of this table is formed of a central fixed section, to which are hinged end sections formed of a series of slats hinged together, depending brackets carrying the end legs and receiving the slats of the end sections. The improvement relates especially to "roll top" extension tables, providing means whereby the ends of the table will present a square, flat appearance, while the table is designed to be very durable and of economical construction.

BARREL.—Emerson Cole, Brooklyn, N. Y. This invention provides a barrel or packing case made from pasteboard or thin wood sheets, with light and strong hoops. A novel method and means are provided for the removable attachment of the heads to the cylindrical or bilged body, to secure strength and lightness, and by the peculiar construction of the body, a variation in diameter at the ends is afforded by lap joints that remain tight if the diameter is altered.

GAME COUNTER.—William B. Herbert, Galveston, Texas. This is a tabular device for games, petty cash, etc., consisting of a card, slate, or tablet, ruled to form horizontal rows of counting squares, and perpendicular columns numbered to form multiple. The counter may be inclosed in a frame and covered in part or in whole with a plate of ground glass, or other transparent or translucent material adapted to be written on with a lead or other pencil.

DESIGN FOR PRINTED FABRIC.—Samuel M. Schwab, Jr., New York City. This is a pattern design, consisting of figures simulating dogs arranged in pairs, while adjacent are other figures simulating the lower body and leg portions of the animals represented on the fabric.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

TEMPERAMENT, DISEASE AND HEALTH. By French Ensor Chadwick. G. P. Putnam's Sons. 1892. Pp. vi, 85. Price 75 cents. No index.

The author has produced this work, as he states primarily, to put forward two ideas. The first one is that there is associated with temperament a specific rate of change; the second one is that the failure to keep up that rate, which is a failure to have elimination keep pace with accession of material, is the principal cause of organic disease. Commander Chadwick treats this subject in a most practical and readable way, and we believe that his work will be found of considerable popular interest.

PHOTOGRAPHY ANNUAL FOR 1892. Edited by Henry Sturmey. London: Iliffe & Son. 12mo. Pp. 898, 280. Price 2 shillings and 6 pence.

This annual, in addition to articles on the progress and practice of photography, contains a careful classified list of novelties and improvements in photographic apparatus and materials. This section of the work is finely illustrated and forms in fact a complete cyclopedia of photographic apparatus up to date, when taken in connection with "Photography Annual for 1891" and "The Photographer's Indispensable Handbook." The plates illustrating the improvements in photo-mechanical processes are admirably executed and the subjects are well chosen. The list of English photographic societies, with their officers, is very complete. The advertisements render the work rather bulky.

DIE ANWENDUNGEN DER PHOTOGRAPHIE DARGESTELLT FUR AMATEURE UND TOURISTEN. Von G. Pizzighelli. Halle, Germany: Wilhelm Knapp, publisher. 1892. Pp. 496. 8vo, paper. Price 8 marks.

This work on the applications of photography, for the use of amateurs and students, is accompanied by 284 well executed cuts. The two previous volumes of Pizzighelli's great work have treated respectively of the apparatus and the processes of photography, while the present work treats of the application of photography to science and art. Great attention is given to the selection and composition of subjects, and many new points are brought out in regard to such subjects as moonlight views, panoramaphotography, views from mountain heights, views in winter, views from the water, etc. Aeronautic photography occupies an important place in this work. The application of photography to physics, meteorology, microscopy, and astronomy are treated in a remarkably clear manner. Probably the most novel chapter is that relating to judicial photography, which contains a description of the method of photographing and measuring criminals as used by the police of Paris. Chrox photography, though comparatively a new branch, assumed large proportions, and the section devoted is very complete. The work is accompanied by a full bibliography and shows the marks of care which are usually found in German scientific works. The book can be confidently recommended to all who read German.

PHOTO-ENGRAVING. A practical treatise on the production of printing blocks by modern photographic methods. By Carl Schraubstadter, Jr. St. Louis. 1892. Pp. 132, 8vo. Price $3.

This new work is a welcome addition to the literature of photo-engraving. The book treats of the arrangement, equipment and maintenance of a photo-engraver's establishment. The work is illustrated with sixty engravings and contains chapters on zinc etching, half-tone work, single and double washout and swelled gelatine processes.

COPY FOR PHOTO-ENGRAVING. By Carl Schraubstadter, Jr. St. Louis. Pamphlet. Price 25 cents.

Treats of copy and its preparation and forms a necessary companion to "Photo-Engraving."

© 1892 SCIENTIFIC AMERICAN, INC.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

For Sale—A 25 H. P. Otto gas engine. Strictly first class order. Price low. Immediate delivery. W. P. Davis, Rochester, N. Y.

Acme engine, 1 to 5 H. P. See adv. next issue.

"U. S." metal polish. Indianapolis. Samples free.

Drop presses a specialty. Am. Tool Works, Clev., O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

6 Spindle Turret Drill Presses. A.D. Quint, Hartford, Ct.

Best baling presses. Ryther Mfg. Co., Watertown, N.Y.

Universal and Plain Milling Machines.
Pedrick & Ayer, Philadelphia, Pa.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Centrifugal Pumps for paper and pulp mills. Irrigating and sand pumping plants. Irvin Van Wie, Syracuse, N. Y.

Special machinery for cutting, spinning, and drawing sheet metal. Empire Machine and Tool Co., New Brunswick, N. J.

Wanted—One Bliss double action press, about No. 3½. Must be in perfect order. Address, stating price, Letter Carrier, No. 9, Black Rock, Buffalo, N. Y.

To Let—A suite of desirable offices, adjacent to the Scientific American offices, to let at moderate terms. Apply to Munn & Co., 361 Broadway, New York.

Machinery Wanted—Hydraulic press of at least 500 tons pressure, and suitable for jewelers or silversmiths. Full particulars to Hydraulic, box 773, New York.

For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Canning machinery outfits complete, oil burners for soldering, air pumps, can wipers, can testers, labeling machines. Presses and dies. Burt Mfg. Co., Rochester, N. Y.

Competent persons who desire agencies for a new popular book, of ready sale, with handsome profit, may apply to Munn & Co., Scientific American office, 361 Broadway, New York.

Foreman Moulder Wanted—Accustomed to dry sand castings, for foundry within 60 miles of New York. Good wages to a suitable man. Apply, stating experience, wages expected, and full particulars. Address Hudson River, care of Scientific American.

Wanted—A successful inventor and efficient designer of harvesting machinery. Must be also an experienced and practical mechanic. Also want a thoroughly competent patternmaker. Both for our new works at Minneapolis, Minn. State experience and salary expected. Give references. Address Esterly Harvesting Machine Co., Whitewater, Wis.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(4537) W. B. R. asks: Why does the air end of an air pump such as is used on locomotive engines sometimes get hot when pumping air? What makes the sound that we hear when a locomotive engine exhausts in the stack? A. The air pump on a locomotive is an air compressor. The compression of air and gases develops heat. Any volume of air contains a certain amount of heat, the exponent of which is the temperature. When the volume is suddenly compressed into a part only of its original volume, the same quantity of heat remains, but in a smaller space, which causes the temperature to rise in proportion to amount of compression. The sound of the exhaust the smoke stack is from the vibration of the air, due the suddenness of the operation, the exhaust acting like an explosion.

(4538) W. E. K. asks (1) how to obtain formic acid. A. In various ways; the dry distillation of oxalic acid is the simplest. It is made by the oxidation of gum and other organic substances by mixing 1 part of organic matter with 3 parts of manganese dioxide and 2 parts of water; 3 parts of sulphuric acid 50 per cent are added and in a short time the mixture is distilled. 2. How to take grease stains from the hands off the piano keys. A. Cover with glass and expose to the sun. 3. A cure for pimples. A. Consult a physician. Try washing the face with solution of Rochelle salts.

(4539) W. P. asks (1) for the best method to fasten rubber to steel without using rivets or similar devices. A. Use bicycle tire cement or marine glue. 2. Is there any difference between a series or shunt dynamo, provided everything is in the same proportion as near as possible to construct them, in regard to the E.M.F., that is, let both machines be of the same size and run at the same speed. A. The series dynamo gives the highest E. M. F. on open circuit, the shunt on closed circuit. As regards maximum E.M.F., they may be considered identical.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

September 20, 1892.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising apparatus for cash registers, H. Cook ... 482,722
Aerated liquids, apparatus for the manufacture of, L. G. & S. M. Chinnery ... 482,841
Agricultural machine, J. F. Thompson ... 483,026
Air compressor, coin-operated automatic hydraulic, R. F. Avery ... 482,775
Anchors, foot for dredge, Pike & McDairmid ... 483,012
Arm, artificial, J. E. Wortham ... 483,090
Armature winding for dynamo-electric machines, R. Eickemeyer ... 482,825
Axle box, O. Collins ... 483,045
Axle cutter, J. Swegles ... 482,767
Axle lubricator, J. Q. Finch ... 482,918
Axle lubricator, G. L. Weaver ... 482,770
Bag. See Nose bag.
Battery. See Storage battery.
Bearing for vehicle wheels, ball, E. S. Frazier ... 482,896
Bedstead, G. H. Currey ... 482,725
Beer with carbonic acid, apparatus for charging, J. B. Stobaeus ... 482,881
Bell, E. S. Piper ... 482,983, 482,984
Bell, bicycle, E. D. Rockwell ... 483,084
Beverage, effervescent, O. M. Hechtman ... 482,738
Beverages, preparation for, A. S. Krueger ... 483,067
Bevel gauge, double blade, J. Fox ... 482,888
Bicycle, O. Hanson ... 482,735
Bicycle, A. Tremblay ... 482,856
Bicycles, child's seat or parcel carrier for, M. E. Blood ... 482,988
Bier, G. Begley ... 483,038
Bit. See Bridle bit.
Bituminous rock reducing machine, J. T. Cochran ... 482,914
Blank case, J. F. Wilmot ... 482,990
Blind stile mortising machine, P. H. Larcher ... 482,849
Blind stop, F. Blauss ... 483,096
Block. See Building block.
Boiler. See Steam boiler.
Boiler, W. B. Fowler ... 482,999
Boiler attachment, steam, F. F. Landis ... 492,848
Boiler for marine engines, W. B. Fowler ... 483,000
Book or portfolio, C. B. Lebkicher ... 483,068
Boomerang, C. G. Stevens ... 482,852
Boring machine, C. S. Harris ... 482,791
Bottle filling machine, Clauss, Jr., & Schomburg, 482,893, 482,894
Bottles, apparatus for fixing capsules on, C. Scherer ... 483,019
Box. See Letter box.
Box nailing machine, S. H. Edwards ... 482,866
Brace. See Shoulder brace.
Brake. See Wagon brake.
Branding stamp, J. S. Fitzmaurice ... 483,050
Brick, L. H. & H. H. De Fernelmont ... 483,105
Bridle bit, J. Dean ... 483,103, 483,104
Bucket, dinner, H. J. Sibley ... 482,761
Bucket elevator, J. Cavanagh ... 482,941
Buckle, S. E. Cook ... 482,915
Building block, C. Grunzweig ... 482,890
Bung, Anthony & Savage ... 483,035
Bung, J. Baeumle ... 482,713, 482,714
Burner. See Straw burner. Vapor burner.
Button, C. A. Bryant ... 482,959
Cable securing device, Bossert & Findlay ... 482,939
Calendar, Rendell & Pinney ... 482,929
Caliper joint, W. H. Isbell ... 483,065
Can or vessel stopper, fluid, W. H. Payne ... 483,082
Can washer, C. H. Southard ... 482,763
Cane juice bleaching apparatus, A. F. Slangerup ... 483,022
Cane, whip, M. O. Felker ... 482,895
Cap, bathing, H. B. Williams ... 482,773
Car coupling, J. M. Elliott, Jr. ... 483,047, 483,048
Car coupling, R. Kleinert ... 482,904
Car coupling, B. H. Paugh ... 482,926
Car coupling, J. F. Pursley ... 482,809
Car coupling, T. L. Rivers ... 482,833
Car coupling, Underwood & Clum ... 482,769
Car coupling, J. A. Wiswall ... 482,774
Car gas lighting tanks from gas mains, apparatus for charging, R. M. Dixon ... 483,106
Car mover, C. W. Pierce ... 482,878
Car roof, J. C. Wands ... 483,032
Car sign, C. S. Reed ... 482,928
Car, vestibule, J. Krehbiel ... 482,744
Car wheel, G. Hull ... 483,064
Carbon holder, E. P. Warner ... 482,820
Carbureting apparatus, air, J. E. Mendenhall ... 483,003
Carpet stretcher, J. Albin ... 482,821
Carpet stretcher, R. Harrison ... 483,057
Carriage, child's, F. Bornemann ... 482,779
Carriage, two-seated, F. N. & O. Vanier ... 482,858
Case. See Blank case. Packing case. Ribbon and show case.
Cash and package carrier apparatus, S. W. Barr ... 482,822
Cash indicator and register, Parkhurst & Ham ... 483,010
Cash indicator and register, J. Sharpe ... 482,760
Cash register, B. F. Wright ... 482,956
Cash registering and adding machine, C. Paine ... 483,009
Cattle guard, surface, J. S. Berry ... 483,039
Chain, drive, T. Corscaden ... 482,723
Chair. See Railway chair. Railway brace chair. Railway rail chair.
Chair, P. C. Lewis ... 482,745
Check, meal, F. C. Gellenbeck ... 482,899
Cheese, making, J. D. Frederiksen ... 482,897
Chimney cap, W. A. Pearce ... 482,851
Chimney cap or ventilator, G. M. McCloskey ... 482,905
Chopper, J. E. Auzat ... 482,838
Cigar bunch cutter, Miller & Yeiser ... 483,077
Cigar bunching machine, N. Strotz ... 482,882
Circuit switch, Russell, Jr., & Minor ... 483,123
Clay, etc., drying and disintegrating, F. D. Cummer ... 482,823
Cleaner. See Fruit cleaner.
Clock regulator, W. E. Porter ... 482,985
Clod crushers or pulverizers, roller for, C. H. Noblet ... 483,007
Closet. See Dry closet. Water closet.
Coupling. See Car coupling. Pipe coupling.
Coffee huller, W. H. B. Stout ... 482,909
Colander for mashing vegetables, P. Patroli ... 482,902
Collar pad, horse, R. O. Randall ... 483,016
Collars and cuffs, machine for turning, J. H. Young ... 482,859
Comb, E. H. Harpham ... 483,058
Combing fibrous materials, machine for, Donisthorpe & Burrows ... 482,960
Conformator, A. S. Adler ... 482,911
Conveying apparatus, I. N. Rowe ... 483,120
Cooker, J. H. Gardner ... 482,898
Corn popper, I. M. Palmer ... 482,832
Cotton gins, pneumatic feeder for, J. Cornellison ... 482,916
Crate, H. C. Burkhead ... 483,101
Crusher. See Clod crusher. Rock crusher.
Crutch, R. M. Lamp ... 483,118
Cultivator, J. Gedeobn ... 482,919
Cultivator, Mallery & Youngs ... 482,746
Cultivator, J. A. Martin ... 483,075
Cultivator, Wages & Armstrong ... 483,031
Cultivator attachment, A. Dyer ... 482,729
Current motor, alternating, O. T. Blathy ... 482,974
Curtain fixture, F. H. Bassett ... 482,716
Cutter. See Axle cutter. Cigar bunch cutter.
Derrick drum, A. C. French ... 483,052
Dial transmitter, F. Pearce ... 482,877
Disinfecting and deodorizing cover for commodes, water closets, etc., J. Kinney ... 482,966
Door closer, E. M. Wyant ... 482,836
Door fastener, Tanner & Burch ... 482,817
Draught attachment, vehicle, H. Barber ... 482,973
Drum, heating, S. M. Kemp ... 483,116
Dry closet, C. B. Tompkins ... 482,987
Electric conductor joint, J. W. Marsh ... 483,074
Electric switch and case, A. Wright ... 482,936
Electrolytic apparatus, T. Craney ... 482,724
Elevator. See Bucket elevator.
Elevator safety attachment, A. A. Stoltzenburg ... 483,025
End gate, wagon, G. S. Sneer ... 482,835
Engine. See Rotary engine. Steam engine.
Excavating device, McBride & Fisher ... 483,004
Exhibition apparatus, subterranean, H. Hardy ... 482,736
Fabric. See Woven fabric.
Fare register and recorder, C. Crook ... 483,102
Faucet, measuring, C. W. Steinmetz ... 482,815
Fence post, iron, C. W. Holm ... 483,060
Fence tool, combination, J. W. Gallant ... 482,827
Filing device, paper, H. A. Winternight ... 483,089
Fire escape, M. Schwarz ... 482,813
Fire shield, W. M. Herrington ... 482,844
Firemen, electric signaling device for, G. L. Barnard ... 482,778
Flood gate, automatic, S. Flinn ... 482,868
Friction, means for reducing, G. M. Guerrant ... 482,902
Friction wheel, A. J. Davis ... 482,788
Fruit cleaner, Bardsley & Parkinson ... 482,937
Furnace, F. L. Higgins ... 482,741
Furnace, liquid fuel, G. Rose ... 482,834
Game apparatus J. Green ... 483,109
Game apparatus, E. D. Howell ... 483,062
Game apparatus, S. N. Johnson ... 483,115
Game counter, F. A. Gilbert ... 482,961
Game for amusement, J. S. Malin *et al* ... 482,747
Gas, apparatus for the manufacture of, McBride & Fisher ... 483,005
Gas holder, K. G. Barkhausen ... 482,891
Gas making apparatus, Elkins & Boeklen ... 483,107
Gate. See End gate. Flood gate.
Gate, F. Hopkins ... 482,792
Glass, embedding wire netting in, F. Shuman ... 483,021
Glass, machine for embedding wire netting in, F. Shuman ... 483,020
Grain binder, G. Schubert ... 482,758
Grain dump, J. P. Peterson ... 483,011
Grain treating apparatus, F. B. Giesler ... 482,790
Graphoscope, F. E. Housh ... 482,793
Gravel trains, means for unloading, Stratton & Drake ... 482,951
Grinding machine tool rest, D. L. Brown ... 483,042
Grinding mill, C. C. L. Lucht ... 482,873
Grounding machine, J. Hope ... 482,947
Guard. See Cattle guard. Shaft guard.
Hame staple, adjustable, J. G. & W. H. Haglock ... 483,111
Hammer, power, S. Trethewey ... 482,988
Handles, form for holding shovel, W. H. Johnson ... 483,114
Harness snap, T. V. Wallace ... 482,895
Harvester, M. Kimberlin ... 482,924
Harvester, M. H. Melrose ... 482,968
Harvester, corn, Hanson & Farnham ... 482,945
Harvesters, sheaf carrier for self-binding, J. F. Steward ... 482,931
Hat, cap, etc., A. Rosenthal ... 482,950
Holder. See Gas holder. Penholder. Shade holder.
Hook and eye, Edwards & Barclay ... 482,867
Horse detacher, E. Hays ... 483,059
Horseshoe, W. Kondakoff ... 482,845
Horseshoe, spring heel, D. C. Dwyer ... 482,998
Huller. See Coffee huller.
Hydraulic motor, S. Forter ... 482,732
Hydraulic motor, M. Van Ensley ... 482,976
Hydrocarbon burning apparatus, J. H. Bullard, 483,099, 483,100
Ice cream freezer, C. T. Van Sicklen ... 483,028
Ice cream freezer, E. P. Voisard ... 483,029
Ice shave, J. Stubbs ... 482,883
Ice plow, H. Pray ... 483,015
Incubator, J. S. Rubel ... 482,755
Indicator. See Cash indicator.
Indicator lock, Young & Littel ... 483,092
Ink well, J. W. MacDonald ... 483,072
Insect catcher, W. A. McAdams ... 483,079
Insulated electric wire, T. L. Reed ... 482,753
Insulator, H. H. Brooks ... 482,913
Insulator, C. T. Lee ... 482,872
Jar, A. Weissenthanner ... 483,033
Jar filler and holder, I. M. & I. M Fisher ... 483,049
Joint. See Caliper joint. Electric conductor joint. Rail joint.
Knitting machines, automatic chain motion for, D. C. Bellis ... 482,892
Knob, F. A. Wilmot ... 482,953, 482,954
Knobs to shanks, attaching, F. A. Wilmot ... 482,952
Lamp, L. A. Cooper ... 482,994
Lamp attachment, electric, J. Clift ... 483,044
Lamp, electric arc, J. A. Stuart ... 482,986
Lamp frame, electric arc, Bossert & Findlay ... 482,940
Lamp support, A. H. Lucas ... 483,071
Lamps, suspension bracket for electric, T. Dillon ... 482,727
Latch, M. R. Hubbell ... 482,794
Lath yarns, machine for cutting, H. S. Dix ... 482,917
Lathe, C. H. Baush ... 482,991
Lawn sprinkler, N. L. Rigby ... 483,017
Letter box, L. T. Light ... 483,070
Lighting and heating apparatus, J. D. Luther ... 482,874
Linoleum floor cloth, device for manufacturing, T. Mitchell ... 482,948
Liquor purifying and aging apparatus, C. Heintz ... 482,843
Lock. See Indicator lock.
Lock, W. Nehring ... 482,970
Locomotive, C. L. Heisler ... 482,828
Locomotive, electric, C. M. Conradson ... 482,863
Loom picker staff buffer, E. Hamilton ... 482,977
Loom stop motion, J. J. Shanahan ... 482,930
Looms for weaving pile fabrics, method of and means for lubricating the wires in, Marchetti & Mellor ... 483,073
Lubricator. See Axle lubricator.
Lumber, barbed strap for bunching, E. C. Binet ... 483,040
Manure spreader, W. Compton ... 482,785
Mat, W. M. Marshall ... 482,980
Measuring and draughting device for garments, C. Mannebach ... 482,748
Meat tenderer, F. B. Jordan ... 483,002
Mechanical motor, D. J. Dean ... 483,046
Mechanical movement, P. A. Bouchet ... 483,041
Mechanical movement, C. A. Holcomb ... 482,743
Melting pot cover, J. A. St. John ... 482,880
Mill. See Grinding mill.
Mill appliance, J. A. Burns ... 482,861
Moulding, F. E. Gordon ... 482,901
Mouldings, means for hanging, N. Hoffend ... 482,742
Motor. See Current motor. Hydraulic motor. Mechanical motor. Pump motor. Water motor.
Mower, lawn, W. E. & F. J. Prindle ... 482,752
Mucilage holder, F. H. Palmer ... 482,750
Music or like engravings, producing, C. A. Ker ... 482,871
Nail machine attachment, cut, C. F. Roth ... 483,085
Nose bag, W. Ehrhardt ... 482,730
Nut lock, A. P. Nelms ... 482,949
Nut lock, J. G. Perry ... 482,907
Nut lock, J. W. Willcoxon ... 482,935
Nut lock, C. C. Wrenshall ... 482,910
Nut lock and bolt tightener, J. G. Perry ... 482,906
Ore separator, H. H. Taylor ... 482,853
Packing case, G. W. Banker ... 482,715
Packing for piston or other rods, F. Pinch ... 483,013
Pad. See Collar pad.
Pail, sanitary, C. Baron ... 483,036
Paper tubes, composition coating for, S. Bergmann ... 482,718
Penholder, G. McElwain ... 482,925
Pencil sharpener, C. Faber ... 482,826
Photographic shutter, J. E. Thornton ... 482,854
Photographs, pictures, and analogous articles, support for, A. Hunter ... 482,978
Piano action, upright, A. Hicks ... 482,740
Piano attachment, H. A. Hauff ... 482,737
Picker stem and mechanism for operating the same, G. N. Todd ... 483,121
Pipe coupling, R. Herman ... 482,922
Planter and fertilizer distributer, A. Bush ... 482,783
Planter, seed, E. R. Knight ... 483,066
Plow, F. F. Landis ... 482,847
Plow, C. A. Pfeifer ... 482,751
Plow, C. H. Vanderburg ... 482,884
Plow, sulky, L. S. Flatau ... 482,943
Plow, sulky, M. Glynn ... 482,734
Plow, wheel, E. Stock ... 482,816
Pneumatic tool, D. Drawbaugh ... 482,942
Post. See Fence post.
Pressure regulator, G. Harris ... 482,842
Printing machine, T. Gibson ... 482,733
Printing machine, music, L. Durdilly ... 482,728
Propeller, vessel, D. Urch ... 482,122
Pump strainer, rotary, T. Volstorf ... 483,030
Pump, M. W. Hall ... 482,921
Pump, A. N. Woodard ... 483,034
Pump, force, M. W. Hall ... 482,944
Pump, hydraulic mining, Rockliff & Foley ... 482,810
Pump motor, Miller & Oswalt ... 482,800
Pump or compressor, air, R. F. Avery ... 482,776
Pump, steam, C. H. Booth ... 482,840
Pump, steam actuated air, E. Smedley ... 482,814
Pumps by means of treadles, device for operating, R. F. Avery ... 482,777
Punching machine, T. Barrow ... 483,095
Punching presses, feeding device for card, J. P. Odgers ... 482,981
Rack. See Towel rack.
Rail and chair, channel, A. J. Moxham ... 482,803
Rail, guard, S. H. Stupakoff ... 482,766
Rail joint, T. J. Kennedy ... 482,796
Railway brace chair, G. Murray ... 482,807
Railway chair, S. H. Stupakoff ... 482,765
Railway conduit, electric, F. O. Blackwell ... 482,719
Railway conduit, electric, R. M. Hunter ... 482,964
Railway rail and chair and making the same, combined, A. J. Moxham ... 482,805
Railway rail chair, A. J. Moxham ... 482,801, 482,802
Railway rail chair and making the same, A. J. Moxham ... 482,804
Railway switch appliance, street, J. P. Holedger ... 482,903
Railway tie, metal, R. E. Daniels ... 482,997
Railway tie, metallic, C. B. Macneal ... 482,967
Railway trolley stand, electric, J. C. Hough ... 483,061
Railways closed conduit for electric, L. P. Bunce ... 482,993
Razor pivot, J. G. Bestgen ... 482,992
Reel for unwinding tubular knitted goods and winding the yarn, N. Tourangeau ... 482,932
Refrigerating machines, gas compressor for, B. H. Munsch ... 422,876
Register. See Cash register. Fare register.
Regulator. See Clock regulator. Pressure regulator. Windmill regulator.
Resonator, H. Crocker ... 482,786
Ribbon and show case, E. Stewart ... 483,024
Road roller, combination, R. C. Ruthven ... 482,757
Rock crusher, H. L. Kent ... 482,795
Roller. See Road roller.
Rope grip, T. J. Cope ... 482,975
Rope hold, E. T. Rugg ... 482,756
Rotary engine, E. Towlson ... 483,027
Ruler, gauge, and circle scriber, combined, Weaver & Leiser ... 482,886
Saddle tree, R. C. Barry ... 483,037
Sanding apparatus, Wallace & Penfield ... 483,088
Sawing up slabs, etc., machine for, Maffett & Weir ... 482,799
Scale, pendulum, D. Olmsted ... 482,831
Scraper, road, J. S. Palmer ... 483,081
Screen. See Window screen.
Screw cutting machine, J. A. Hamer ... 483,112
Separator. See Ore separator.
Sewing machine attachment, A. A. Bouton ... 483,097
Sewing machine frame, B. F. Bellows ... 482,958
Sewing machine shuttle, A. M. Leslie ... 482,850
Sewing machine waxing device, M. H. Pearson ... 483,083
Sewing machines, carriage for carrying and operating, M. W. Lawrence ... 482,829
Shade holder, F. Adams ... 482,887
Shade or screen, window, M. M. Killinger ... 482,798
Shade, window, M. M. Killinger ... 482,797
Shaft guard, vehicle, F. De La Matyr ... 482,726
Shears, T. N. Underwood ... 482,857
Sheet metal articles, means for ornamenting, Abell & Ostrander ... 482,837
Sheet metal, die for drawing, E. Norton ... 483,008
Sheet metal, machine for edge curling, Gordon & Gilbert ... 482,962
Shelf, corner bracket, J. D. Legg ... 483,069
Ships, ash ejector for, H. See ... 482,759
Shoulder brace, W. J. Teufel ... 482,768
Shutter stand, window, A. D. Webster ... 482,771
Skate, roller, J. Carrie ... 482,721
Skewer or needle for closing fowls, etc., E. Musso ... 482,969
Smoke and spark arrester and consumer, E. J. Hadlock ... 483,055
Snow plow, A. B. Black ... 482,720
Spindle ends, machine for cutting, J. A. Williams ... 482,934
Spinning spindle support, J. Blair ... 482,860
Split wheel, C. M. Conradson ... 482,864
Spring. See Vehicle spring.
Spring bending and forming machine, E. W. Ansted ... 483,094
Sprinkler. See Lawn sprinkler.
Square, folding, W. H. Goldsberry ... 482,900
Steam boiler, O. Crosby ... 482,787
Steam engine, J. W. Powers ... 483,014
Steam trap, N. Nilson ... 483,119
Stirrup, R. H. Dacus ... 482,996
Stool and coal receptacle, combined, F. Bornemann ... 482,912
Stopper. See Can or vessel stopper.
Storage battery, E. R. Knowles ... 482,979
Storage rooms, construction of, W. Griesser ... 482,889
Stove, combined cooking and hot water heating, M. A. Wilcox ... 482,772
Stove for bricks, etc., drying, A. Schaaf ... 483,018
Stove, gas heating, E. Ruud ... 483,086
Stove pipe fastener, J. R. McGoron ... 482,808
Stove, vapor, R. Flick ... 483,051
Stoves or ranges, oven door for cooking, F. V. Knauss ... 483,117
Straw burner, G. A. Byor ... 482,862
Suspenders, E. Gutmann ... 482,963
Swaging machine, C. H. Yarington ... 483,091
Switch. See Circuit switch. Electric switch.
Switch shifter, Gilstrap & Brown ... 483,053
Switch stand, S. Jobe ... 482,870
Tap, pipe, E. M. Wolfe ... 482,955
Tea kettle, V. C. Baker ... 482,972
Telegraph, signal, C. V. Boughton ... 482,780
Thrashing machine fan and regulator, F. F. Landis ... 482,846
Tie. See Railway tie.
Tire, elastic, C. Wagner ... 482,819
Top rolls, saddle for, E. Dixon ... 482,789
Towel rack, Huber & Marvin ... 482,869
Toy, J. A. Allen ... 482,957
Toy, G. W. Thomas ... 483,087
Trace fastener, D. E. Smith ... 482,762
Trap. See Steam trap.
Truck, A. Nichless ... 483,006
Truss, C. A. Harvey ... 482,946
Tubing, shoe for cistern, E. Sahland ... 482,812
Tug, thill, S. Stewart ... 482,764
Type, A. Coleman ... 482,784
Typewriting machine, B. A. Brooks ... 482,761
Typograph attachment, J. Slocum ... 483,023
Upholstery spring support, J. A. Staples ... 482,908
Urinal, W. S. Ross ... 482,754
Valve, balanced slide, M. A. Green ... 483,054
Valve, electrical stop, A. Franke ... 483,108
Vapor burner, H. S. Giles ... 482,920
Vehicle running gear, C. M. Blydenburgh ... 482,839
Vehicle spring, J. W. Wetmore ... 482,933
Vehicle, two-wheeled, J. W. Hewitt ... 482,739
Vender, newspaper, A. E. Dain ... 482,824
Vending apparatus, coin controlled, J. G. Macpherson ... 482,875
Vending machine, coin operated, W. R. Ziegler ... 483,093
Vinegar making apparatus, R. M. Hughes ... 483,063
Wagon brake, E. G. & W. A. Haney ... 483,056
Wagon, dumping, Field & Shedd ... 482,731
Wall paper, roller knife for trimming, D. S. Morgan ... 482,830
Washer. See Can washer.
Watch case pendant, C. Arthur ... 482,971
Water closet, Jennings & Morley ... 482,923
Water motor, L. Porter ... 482,927
Water tower and fire escape, combined, F. M. Hughes ... 483,001
Weather strip, D. D. Mayfield ... 483,076
Well adjusting apparatus, oil, Wadsworth & Sheesley ... 482,818
Wheel. See Car wheel. Split wheel. Traction wheel. Wind wheel.
Wheel, T. C. Munz ... 482,806
Whip socket, F. E. Benton ... 482,717
Wind wheel, E. Bregier ... 483,098
Windlass, J. J. Hamblin ... 483,113
Windmill regulator, E. C. Norton ... 483,080
Window cleaners, safety device for, R. d'Heureuse ... 482,865
Window frame and sash, J. Wilson ... 482,989
Window screen, S. Roebuck ... 482,811
Wire, etc., manufacture of rubber coated, T. Guilleaume ... 483,110
Wire, method of and apparatus for coiling and inserting, C. Jackson ... 482,965
Wire, method of and apparatus for tempering, F. Purdy ... 482,879
Wire with fibrous material, apparatus for covering, J. Buckner ... 483,043
Wood decorating machine, Tilton & Hormel ... 482,855
Wood, process of and machine for bending and drying, R. P. Burkhardt ... 482,782
Wool, extracting fat from, W. T. Cutter ... 482,995
Woven fabric, figured, A. & J. Morton ... 483,078
Wrench, F. Mossberg ... 482,749

DESIGNS.

Lens for illuminating tiles, etc., J. Jacobs ... 21,861
Memorial shield, W. Mayer ... 21,862
Paper weight, L. J. Heffernan ... 21,863
Pencil sharpener, S. A. Davis ... 21,864
Suspender ring, F. W. Shillitto ... 21,860

TRADE MARKS.

Beer, lager, National Brewing Company of Baltimore County, Maryland ... 21,772
Candy, chocolate, and cocoa for confectioners' use, Ode & Gerbereux ... 21,774
Cloaks and suits, ladies' and misses', A. Popkin & Co ... 21,756
Confectionery, A. L. Causse Manufacturing Company ... 21,757
Corsets, waists, and suspenders, Coronet Corset Company ... 21,758
Gems, artificial, F. H. Sadler & Co ... 21,759
Hoes, forks, rakes, and other agricultural hand implements, Iowa Farming Tool Company ... 21,771
Insulated wire, electric, Eastern Electric Cable Company ... 21,763
Lard, substitute, S. H. Read ... 21,769
Leather, boots, shoes, and other foot wear, East New York Boot, Shoe, and Leather Manufacturing Company ... 21,773
Magazine Monthly, Great Divide Publishing Company ... 21,770
Measures and rammers, powder, Hartley & Graham Co ... 21,765
Medicated lotions and eye waters, R. P. Stericker ... 21,775
Medicines, cough, Dr. Seth Arnold Medical Corporation ... 21,761
Paper, envelopes, and fine cardboard, writing, Hard & Pike ... 21,754
Pills, capsules, and tablets, McKesson & Robbins ... 21,755
Remedies, a line of, J. Williams, Jr ... 21,760
Remedy for catarrh and all diseases of the throat, lungs, and bowels, R. M. Davis ... 21,762
Remedies, temperamental, J. H. Patty ... 21,767
Sedlitz powders, J. F. Gibson ... 21,764
Tobacco, plug, J. G. Penn, *et al* ... 21,768
Underwear, including hosiery, J. S. Lowrey & Co ... 21,766

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

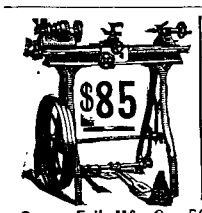
© 1892 SCIENTIFIC AMERICAN, INC.

Advertisements.

Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line
The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

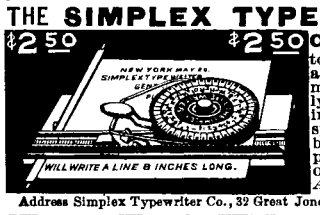
Helios Papers are the best Blueprint papers made. Nigrosine Paper gives facsimiles, black lines on white.
☞ Send for samples.

AGENTS WANTED
In every County throughout the United States to handle our fast-selling specialties; will sell in every home. Send two cent stamp for illustrated catalogue, terms, etc.
ELECTRO-NOVELTY CO.,
5-10 AMORY AVENUE, ROXBURY, MASS.
N.B.—For description of Toy Motors manufactured by us, see July 23d issue *Scientific American*.



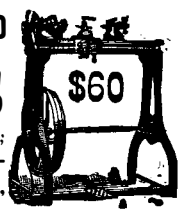
"Star" Foot Lathe Swings 9x25 in.
LATHE
Screw Cutting Automatic Cross Feed, etc.
Scroll Saws, Circular Saws, Lathes Mortisers.
Catalogue Free of all our Machinery.
Seneca Falls Mfg. Co. 569 Water St., Seneca Falls, N.Y.

THE SIMPLEX TYPEWRITER



GUARANTEED to do as good work as any high priced machine. Specially adapted for use in private correspondence. Sent by mail or express prepaid on receipt of $2.70. *See Sci. Am.*, Oct. 1, p. 211.
Address Simplex Typewriter Co., 32 Great Jones Street, New York.

The Sebastian-May Co
Improved Screw Cutting
Foot & Power **LATHES**



Drill Presses, Chucks, Drills, Dogs, and Machinists' and Amateurs' Outfits. *Lathes on trial.* Catalogues mailed on application.
165 to 167 Highland Ave., SIDNEY, OHIO.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS
THOMAS DEVLIN & CO. FINE TINNING JAPANNING AND FINISHING
LEHIGH AVE. & AMERICAN ST. PHILA.

Improved Screw Cutting Foot and Power LATHES
Drill Presses, Shapers, Band, Circular, and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial.
☞ *Catalogue mailed on application.*
SEBASTIAN LATHE COMPANY,
44-46 Central Ave., Cincinnati, O.

RAINMAKERS IN THE UNITED States.—A full account of the operations in the production of rain recently carried out under Federal appropriations in Texas. One illustration. Artificial rain making. By Prof. E. J. Houston. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **824.** Price 10 cents. To be had at this office and from all newsdealers

OIL—LIME—ELECTRIC MAGIC LANTERNS, STEREOPTICONS AND VIEWS.
Large Catalogue Free.
J. B. COLT & CO. { 16 Beekman Street, N. Y. City. 189 La Salle Street, Chicago, Ill.

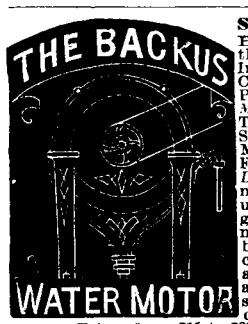
WANTED by an English Engineering Firm, a good invention to work on Royalty. State full particulars to X. X., care of International News Co., 5 Bream's Buildings, Chancery Lane, London, England.

TO BUSINESS MEN

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.

For rates see top of first column of this page or address **MUNN & CO., Publishers.**

361 Broadway, New York.



SUPPLIES FROM HYDRANT PRESSURE, the cheapest power known. Invaluable for blowing Church Organs, running Printing Presses, *Sewing Machines in Households*, Turning Lathes, Scroll Saws, Grindstones, Coffee Mills, Sausage Machines, Feed Cutters, *Electric Lights*, Elevators, etc. It needs little room, no firing up, fuel, ashes, repairs, engineer, explosion, or delay no extra insurance, no coal bills. Is noiseless, neat, compact, steady, will work at any pressure of water above 15 lb.; at 40 lb. pressure has 4 horse power, and capacity up to 10 horse power. Prices from $15 to $300. Send for circular to
The Backus Water Motor Co., Newark, N. J.

BEATTY Piano. Organ. $23 up. Want agents. Cat'g free. Dan'l F. Beatty, Wash'ton, N.J.

ELECTRIC MINING APPARATUS,

Send for our new Catalogue.
ELECTRIC MINE LOCOMOTIVES
ELECTRIC VENTILATING FANS
ELECTRIC HOISTS & ELEVATORS
ELECTRIC COAL CUTTERS.
Send for our new Catalogue.

THOMSON-HOUSTON ELECTRIC COMPANY, MINING DEPARTMENT.
622 ATLANTIC AVENUE, BOSTON, MASS. 173-175 ADAMS STREET, CHICAGO, ILL.

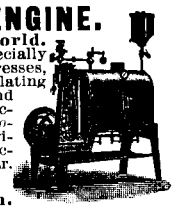
FOR RENT, WATER POWER.—Day use of 250 h. p. (night power used for Electric Light plant). Good railroad facilities. Town of 6,000 population. Address Riverside Water Company, Riverside, California.

ROCK DRILLS

AIR COMPRESSORS &
GENERAL MACHINERY FOR MINING, TUNNELING, QUARRY & RAILROAD WORK.
RAND DRILL Co 23 PARK PLACE NEW YORK

ALUMINUM. AN INTERESTING DESCRIPTION of the various methods of manufacturing this metal, chemical and electrolytic, with special reference to the Heroult method. With 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **753.** Price 10 cents. To be had at this office and from all newsdealers.

OLDS' GASOLINE ENGINE.
Best small power in the world.


One and Two Horse Power, specially adapted for running Printing Presses, Sewing Machines, Lathes, Ventilating Fans, Ice Cream Machines, etc., and for use in small shops and manufactories requiring a *Simple, Safe, Economical* and *Durable* Motor. No engineer. No extra insurance. Satisfaction guaranteed. Send for circular.
P. F. OLDS & SON,
218 River St., Lansing, Mich.

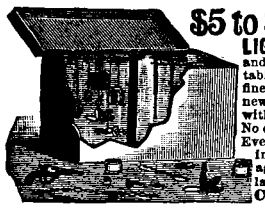
MY WIFE SAYS SHE CANNOT SEE HOW YOU DO IT FOR THE MONEY. **$12** Buys a $65.00 Improved Oxford Singer Sewing Machine; perfect working reliable, finely finished, adapted to light and heavy work, with a complete set of the latest improved attachments free. Each machine guaranteed for 5 years. Buy direct from our factory, and save dealers and agents profit. Send for FREE CATALOGUE.
OXFORD MFG. COMPANY, DEPT D, 18 CHICAGO, ILL.

The Shimer Cutter Heads
45,000 SOLD.

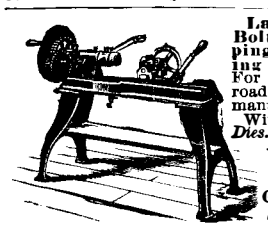
To work Car Siding, Flooring and Ship Lap; to Mould Doors, Sash and Blinds. Cope Heads to match.

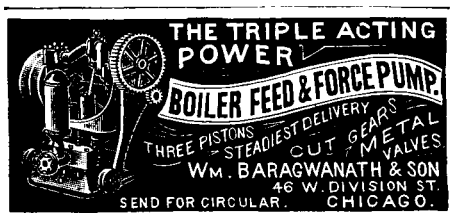
Ceiling.
Sam'l J. Shimer & Sons, Centre St., Milton, Pa.

THE COMPASS.—BY CAPT. D. WILson-Barker, Lieut. R.N.R. A valuable paper on this instrument from a historical, theoretical and practical standpoint. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **859.** Price 10 cents. To be had at this office and from all newsdealers.


$5 to $15 per day, at home, selling **LIGHTNING PLATER** and plating jewelry, watches tableware, &c. Plates the finest of jewelry good as new, on all kinds of metal with gold, silver or nickel. No experience. No capital. Every house has goods needing plating. Wholesale to agents $5. Write for circulars. **H. E. DELNO & Co., Columbus, O.**

PATENTEES.—We introduce goods to wholesale and retail trade. Correspondence solicited. References given. J. L. WELLS & CO., 389 E. Pine St., Portland, Oregon.


Large Variety of Fine Bolt Cutting, Nut Tapping, and Pipe Threading Machines.
For Machine Shops, Railroads, Carriage Makers, and manufacturers in general.
With or without *Opening Dies.* For Hand and Power.
WILEY & RUSSELL MFG. CO.,
Greenfield, Mass., U.S.A.
Send for new Catalogue.

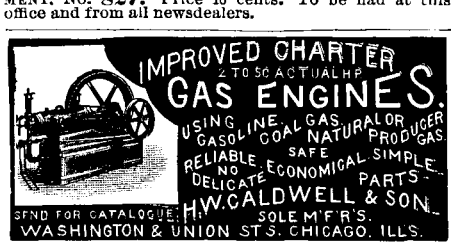


Incubators, Only $12.00
F. WILLIAMS, Bristol, Ct.

The Belknap Little Giant Water Motor

Best Water Motor, most powerful and efficient machine on the market.
Electric Motors and Dynamos.
Combined Water Motors and Dynamos.
Cyclone Coffee Mills for Grocers' use.
Combined Motor and Mill in one case, run by water or electricity.
Write for Circulars.
BELKNAP MOTOR CO.,
23 Plum St., Portland, Maine U. S. A.

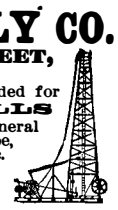
ROLLING FLUID METAL.—A PAPER by Sir Henry Bessemer, F.R.S., on the manufacture of malleable iron and steel direct from fluid metal. With 3 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **827.** Price 10 cents. To be had at this office and from all newsdealers.

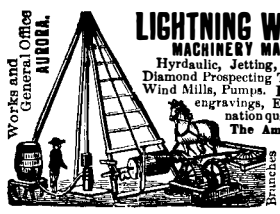


BIT Bores **SMOOTH, ROUND, OVAL,** and **SQUARE HOLES, Mortising Core Boxes,** etc. Invaluable to Carpenters, Cabinet and Pattern Makers. Highest Award. Send $8.00 for set (3/8 to 11-8), in neat case, or 50c. for sample Bit, mailed free with Illustrated List.
BRIDGEPORT GUN IMPLEMENT CO., 315 Broadway, New York.

OIL WELL SUPPLY CO.

91 & 92 WATER STREET,
Pittsburg, Pa.,
Manufacturers of everything needed for
ARTESIAN WELLS
for either Gas, Oil, Water, or Mineral Tests, Boilers, Engines, Pipe, Cordage, Drilling Tools, etc.
Illustrated catalogue, price lists and discount sheets on request.



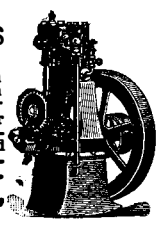


LIGHTNING WELL-SINKING MACHINERY MANUFACTURERS.
Hyrdaulic, Jetting, Revolving, Artesian, Diamond Prospecting Tools, Engines, Boilers, Wind Mills, Pumps. **Encyclopedia,** 1,000 engravings, Earth's Strata, Determination quality water; mailed, 25c.
The American Well Works, Aurora, Ill.
11 & 18 S. Canal St., Chicago, Ill.
Dallas, Texas.

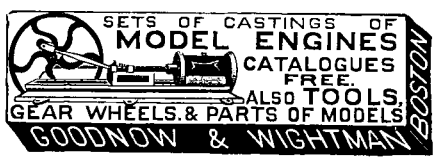
Industrial, Manufacturing, and Uncurrent

SECURITIES DEALT IN.
WORDEN & FANSHAWE,
9 WALL ST., NEW YORK.

"THE SINTZ"
GAS AND GASOLINE ENGINES
Stationary and Marine.


Makes its own supply of gas from gasoline, and at less expense than any other engine. *No boiler, coal, or firemen required.* Runs with either manufactured or natural gas. Specially adapted for small boats and launches and electric light work. Circulars free. ☞ *Mention this paper.*
CLARK SINTZ, MFR.,
Springfield, Ohio.

SPECIAL NOTICE!
Two handsome photo-engraved display sheets entitled,
"Recent Improvements in Air Compressors,"
"Recent Improvements in Rock Drills,"
mailed free to any one who will cut out this advertisement and mail it to us with his name and address.
INGERSOLL-SERGEANT DRILL CO.
No. 10 Park Place, New York, U.S.A.



ALUMINUM: ITS USES AND APplications. A valuable and interesting article by G. L. Addenbrooke. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **859.** Price 10 cents. To be had at this office and from all newsdealers.

Steel Type for Writing Machines,
J. D. MALLONEE, M'f'r, STOCKTON, N. Y.

TO INVENTORS AND MANUFACTURERS
Sixty-first Grand National Exhibition
OF THE
American Institute of the City of New York
Will open October 10 and close December 10, 1892. Intending exhibitors must make early application to secure proper space and classification. For blanks and other information, address CHARLES WAGER HULL, General Superintendent, American Institute, 113 West 33th Street, New York City.

TRADES UNIONS, THE TENDENCY of.—By Herbert Spencer. An able paper, pointing out the great difficulties of dealing with complex social questions. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **801.** Price 10 cents. To be had at this office and from all newsdealers.

A NEW EDITION OF
The Scientific American Reference Book

This attractive little book, of 150 pages, embraces a great variety of information useful for reference in the house and workshop. It contains the last Census of the U. S. by states and counties, and has the area of square miles in each state and territory, with tables of the occupations and the number engaged in each kind of business; lists of cities having 10,000 inhabitants; all the statistics being compiled from the 1890 census; the United States patent laws, with directions how to obtain patents secure caveats, trade marks, design patents and copyrights.

The book contains tables for calculating the horse power of steam engines, and other information useful and varied. The matter crowded between the covers of this little 150 page volume cannot be obtained from any other source. **Price 25 Cents.** May be had of newsmen or by mail.

MUNN & CO.
Publishers of SCIENTIFIC AMERICAN,
361 Broadway, New York.

BOOKS.

Dictionary, Standard Electrical. By T. O'Conor Sloane, Ph.D. 8vo. 600 pages. Illus. Cloth.... **$3.00**
A new dictionary of terms in electrical science and allied branches. The definitions cover the meaning and scope of terms, the electrical constants of all conductors and dielectrics, wire gauge tables and elaborately revised or newly calculated tables of equivalents. The work aims to be the most complete and reliable ever published. Synonyms are given after each title. Cross references are freely used. The work really constitutes a cyclopedia of the science.

Engines. Key to Engines and Engine Running. By Joshua Rose. With numerous illustrations. 410 pages. 12mo, cloth..... **$3.00**

Excelsior Webster Vest Pocket Speller and Definer of the English Language. Containing over 25,000 words. 320 pages, double column. American Russian leather. Indexed..... **.50**

Electric Toy Making, Dynamo Building, and Electric Motor Construction. This work treats of the making at home of Electrical Toys, Electrical Apparatus, Motors, Dynamos and Instruments in general. The numerous illustrations make easy the carrying out of the work. By T. O'Conor Sloane, A.M., E.M., Ph.D. 1892..... **$1.00**

Induction Coils. A Practical Manual for Amateur Coil Makers. With more than 100 illustrations. 238 pages. By G. E. Bonney. 1892..... **$1.00**

Laundry Management. A Handbook for use in Private and Public Laundries, including descriptive accounts of Modern Machinery and Appliances for Laundry Work. By the editor of the *Laundry Journal.* With numerous illustrations..... **$1.00**

Leather Work. A Practical Manual for Learners. By C. G. Leland. With numerous illustrations and original designs by the author. 1892..... **$1.50**

Locomotive Engine Running and Management. By Angus Sinclair. 18th edition. 12mo. 460 pages. 40 illustrations..... **$2.00**

Machinist. Complete Practical Machinist. Embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, Tool Grinding, Marking Out Work, etc. By Joshua Rose. Illustrated by 356 engravings. Fifteenth edition, thoroughly revised and in great part rewritten..... **$2.50**

Machinery Pattern Making. A Discussion of Methods, including Marking and Recording Patterns, Printing Press, Slide Valve and Corliss Cylinders; etc., etc. 376 illustrations. By P. S. Dingey, Practical Pattern Maker. 12mo, cloth..... **$2.00**

Magic Lantern. Its Construction and Management. By a "Practical Hand." With upward of 80 explanatory engravings. London..... **$1.00**

Manures, A Treatise on; or, The Philosophy of Manuring. By A. B. Griffiths. 8vo. Illustrated. Cloth. **$3.00**

Mechanic's Own Book. Spon's Mechanic's Own Book. A Manual for Handicraftsmen and Amateurs. Containing 702 pages. 8vo, cloth. 1,420 illus..... **$2.50**

Mechanical Movements. Five hundred and seven Mechanical Movements, and including many movements never before published. By Henry T. Brown. Seventeenth edition..... **$1.00**

Mechanical Drawing Self-Taught. Comprising Instructions in the Selection and Preparation of Drawing Instruments. By Joshua Rose. Illustrated by 330 engravings..... **$4.00**

Metal Turning. By a Foreman Pattern Maker. Illustrated with 81 engravings. 12mo, cloth..... **$1.50**

Manual of Experimental Engineering. By Prof. R. C. Carpenter, Sibley College, Cornell University. 8vo, cloth. 1892..... **$6.00**

Microscopy. Practical Microscopy. By George E. Davis. Illustrated with 310 illustrations. New and revised edition. One volume, 12mo. 436 pages..... **$3.00**

Milling Machines and Processes. By P. N. Hasluck. 12mo. 352 pages. 300 illustrations. Plates. Cloth..... **$5.00**

Manual of Mining. For the Use of Mining Engineers and Technical Schools. Treating of Preparatory and Exploratory Work, etc., etc. By Prof. Magnus C. Ihlseng, E.M., Ph.D. 8vo, cloth. 450 pages..... **$4.00**

Miner's Pocketbook. A Reference Book for Miners, Mine Surveyors, Geologists, Mineralogists, Millmen, Assayers, Metallurgists and Metal Merchants all over the world. By Lock. 472 pages. Illustrated. Flexible leather, gilt edges..... **$5.00**

Optical Projection. A Treatise on the Use of the Lantern in Exhibition and Scientific Demonstrations. With 232 illustrations. 426 pages. 12mo, cloth.... **$2.25**

Organ Building for Amateurs. A Practical Guide for Home Workers. With over 200 illustrations and explanatory diagrams. By M. Wicks..... **$1.50**

Painter, Gilder and Varnisher's Companion. 12mo. 356 pages. Sixteenth edition. Cloth..... **$1.50**

Perfumes and their Preparation. By G. W. Askinson. 8vo. 312 pages. 32 illus. Cloth..... **$3.00**

Phosphates of America. By F. Wyatt. 8vo. 187 pages. Cloth..... **$4.00**

Photo-Engraving, Photo-Etching and Photo-Lithography in Line and Half-Tone. By W. T. Wilkinson. Revised by E. L. Wilson. 8vo. 188 pages. 23 illustrations. Five plates. Cloth..... **$3.00**

Photography. Its History, Processes, Apparatus and Materials. Comprising working details of all the most important methods. By A. Brothers. With plates of many of the processes described and illustrations on the text. One volume, 8vo, cloth. 364 pages. 1892. **$5.00**

Plumbing, Standard, Practical. By P. J. Davies. 4to. 355 pages. 768 illustrations. Cloth..... **$3.00**

Practical Carriage Building. By M. T. Richardson. Illustrated. Two volumes. Per vol..... **$1.00**

Practical Iron Founding. Illustrated with over 100 engravings. 213 pages. 12mo, cloth..... **$1.00**

Precious Stones and Gems. By E. W. Streeter. 8vo. 355 pages. 17 plates. Cloth..... **$6.00**

Rubber Hand Stamps. Includes also Rubber Cements and the Manufacture of Small Articles of Rubber. 146 pages. 27 illustrations. Cloth..... **$1.00**

Safety Valves. Their History, Invention and Calculation. By W. B. Le Van. 69 illustrations. Pocketbook form..... **$2.00**

Steam Engineer's Guide. The Practical Steam Engineer's Guide, in the Design, Construction and Management of American Stationary, Portable and Steam Fire Engines. For the use of Engineers, Firemen and Steam Users. By Emory Edwards. Illustrated by 119 engravings. 420 pages. 12mo..... **$2.50**

Taxidermy and Zoological Collecting. A Complete Handbook for the Amateur Taxidermist, Collector, Osteologist, Museum Builder, Sportsman and Traveler. By Wm. T. Hornaday, late Chief Taxidermist of U. S. Nat. Museum. With chapters on Collecting and Preserving Insects. Fully illustrated. 1891..... **$2.50**

Telephones. Their Construction and Fitting. A Practical Manual of the Fitting Up and Maintenance of Telephones and the Auxiliary Apparatus. By F. C. Allsop. Fully illustrated..... **$2.00**

Telegraphy. American Telegraphy, Systems, Apparatus, Operation. By Wm. Maver, Jr. One large 8vo volume, 570 pages, with 450 illustrations. 1892.... **$5.00**

Typewriting and Business Correspondence. A Manual of Instruction, Practice Exercises and Business Forms and Expressions, for Shorthand Students and Typewriter Operators. By O. R. Palmer. 1892. **$2.00**

Violin Making, as it Was and as it Is. Being a Historical, Theoretical and Practical Treatise on the Science and Art of Violin Making. By Ed. Heron Allen. With more than 200 illustrations by the author... **$3.00**

Watchmaker's Handbook. A Workshop Companion for those engaged in Watchmaking and the allied Mechanical Arts. From the French of Claudius Saunier. Translated by Julius Tripplin, F.R.A.S., and Edward Rigg, M.A. Second edition, revised with Appendix. 8vo..... **$3.50**

Woodwork. Manual Instruction. By S. Barter. With 292 illustrations. Preface by George Ricks. One volume, 8vo. 343 pages. 1892..... **$2.00**

FREE.

Our entirely new Catalogue of Scientific and Technical Books, containing over 3,000 titles, and embracing more than 300 different subjects, with authors' Index, will be mailed free on application to any address in the world. Address

MUNN & CO.,
Publishers of the "Scientific American,"
361 Broadway, New York.

© 1892 SCIENTIFIC AMERICAN, INC.

ROSE'S
Mechanical Drawing
SELF-TAUGHT.

Fourth Edition, thoroughly revised and corrected.

RECENTLY PUBLISHED.

Mechanical Drawing Self-Taught. Comprising Instructions in the Selection and Preparation of Drawing Instruments, Elementary Instruction in Practical Mechanical Drawing; together with examples in Simple Geometry and Elementary Mechanism, including Screw Threads, Gear Wheels, Mechanical Motions, Engines, and Boilers. By Joshua Rose, M.E. Illustrated by 330 engravings. Fourth edition, thoroughly revised and corrected. 8vo. Price.....$4.00

BY THE SAME AUTHOR.

The Complete Practical Machinist. Embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, Tool Grinding, Marking Out Work, etc. By Joshua Rose, M.E. Illustrated by 356 engravings. Eighteenth edition, thoroughly revised and in great part rewritten. 12mo. 439 pages. Price.....$2.50

The Slide Valve Practically Explained. Embracing Simple and Complete Practical Demonstrations of the Operation of each element in a Slide Valve Movement. By Joshua Rose, M.E. Illustrated by 35 engravings. 12mo. Price.....$1.00

Steam Boilers. A Practical Treatise on Boiler Construction and Examination. For the use of Practical Boiler Makers, Boiler Users, and Inspectors; and embracing in plain figures all the calculations necessary in Designing and Classifying Steam Boilers. By Joshua Rose, M.E. Illustrated by 73 engravings. 8vo. 250 pages. Price.....$2.50

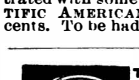
☞ *Illustrated circulars, giving the full tables of contents of all the above works, sent free to anyone who will apply.*

☞ *The above or any of our Books sent by mail, free of postage, at the publication prices, to any address in the world.*

☞ *Our new revised Descriptive Catalogue of Practical and Scientific Books, 88 pages, 8vo, and our Catalogue of Books on Steam and the Steam Engine, Mechanics, Machinery, and Dynamical Engineering, and other Catalogues, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Philadelphia, Pa., U. S. A.

STEEL TYPE FOR TYPEWRITERS



Stencils, Steel Stamps, Rubber and Metal Type Wheels, Dies, etc.
Model and Experimental Work.
Small Machinery, Novelties, etc., manufactured by special contract.
New York Stencil Wks. 100 Nassau St., N. Y

WHAT ELECTRICITY IS.—BY W. W. Jacques. An interesting discussion of the subject, illustrated with some new experiments. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **857**. Price 10 cents. To be had at this office and from all newsdealers.

THE BEST LOOSE PULLEY OILER IN THE WORLD.
VANDUZEN PAT. L. PUL. OILER
Keeps Pulley oiled 3 to 4 weeks with one filling. Cost 25, 30, 40, 50, 65 and 85 cents each. Send Price and **TRY ONE.** State diameter and speed of Pulley. Will send Catalogue free. Mention this paper.
The VANDUZEN & TIFT CO. Cincinnati, O. U.S.A.

DEAFNESS & HEAD NOISES CURED by Peck's Invisible Tubular Ear Cushions. Whispers heard. Successful when all remedies fail. Sold only by F. Hiscox, 853 B'way, N.Y. Write for book of proofs **FREE**

WOODEN TANKS FOR RAILROADS WATER WORKS MILLS FARMS &C.
LARGE WATER TANKS PLANS & A SPECIALTY
SPECIFICATIONS FURNISHED FOR FOUNDATIONS & TOWERS
COMPLETE STOCK OF CYPRESS LUMBER.
W. E. CALDWELL CO
No 217 E. MAIN ST. LOUISVILLE KY.

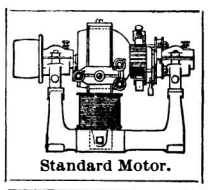
A MODERN BATH.
The Latest and Best.
Quick self-heating or Toilet Cabinet in place of Heater. No bath room required. Ornamental, inexpensive, complete, practical. Desirable for city or town.
Send 2 ct. stamp for catal.
The Mosely Folding Bath Tub Co.,
183 So. Canal St., Chicago.

INVENTORS' IDEAS put into practica working shape by
MILLIKEN & D'AMOUR,
Cor. JOHN AND DUTCH STREETS, NEW YORK CITY.
Machinists, Pattern and Model Makers.

DUST! DUST!
Gibbs Patent **Dust Protector**

rotects the nose and mouth from inhaling poisonous dust. Invaluable in every industry where dust is troublesome. **Perfect** protection with **perfect** ventilation. Inhalation of dust causes **catarrh**, consumption and many other serious disorders. Thousands in use. Price $1.00, postpaid in U. S. and Canada; $1.40 to foreign points.
Gibbs Respirator Co.,
31 La Salle St., Chicago.

CAMPAIGN BADGES
Which Will It Be?
Gold Plate and Finely Finished.
With correct Photographs of the President and Vice President of either party attached on a Red, White and Blue Silk ribbon. New & nobby. Over **7,000,000** Badges sold in 1888. Send for one. Show your colors. Sample by mail **10c.** 75c per doz. 3 doz. assorted designs on cards, $2.50. The above illustration is about half size.
W. HILL & CO.,
Wholesale Jewelers,
207 State St. Chicago, Ill.


Standard Motor.

Crocker-Wheeler Electric Co.
ELECTRIC MOTORS
FOR ALL SPECIAL WORK.
ACKNOWLEDGED TO BE THE STANDARD FOR ALL HIGH-CLASS WORK WHERE POWER IS REQUIRED.
430 WEST FOURTEENTH STREET, NEW YORK.

CHUCKS. Catalogue No. 12, just issued with over 40 new illustrations sent free. Address.
The Cushman Chuck Co., Hartford, Conn.

SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.

ALUMINUM
In all shapes. Manufactured by
Cowles Electric Smelting and Aluminum Co.,
Correspondence solicited. LOCKPORT, N. Y.

BARNES'
New Friction Disk Drill
FOR LIGHT WORK.
Has these Great Advantages: The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive with equal safety the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage.
Send for catalogue.
W. F. & JNO. BARNES CO.,
1999 Ruby St., Rockford, Ill.

CATALOGUE FREE TO ANY ADDRESS.
MODELS AND GEARS

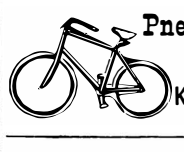
191-193 CLARK ST.
UNION MODEL WORKS. CHICAGO.

SECONDARY BATTERIES.—BY G. H. Robertson, F.C.S. An interesting and valuable paper treating of the types of secondary batteries successfully employed. Historical Notes. Reversible Batteries, Improvements in the Planté System, Electrolytic Processes, Improvements in the Faure Type, Chemistry of the Acid. With 13 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **838**. Price 10 cents. To be had at this office and from all newsdealers.

GATES ROCK & ORE BREAKER

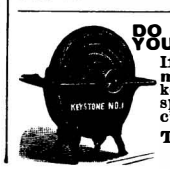
Capacity up to 200 tons per hour.
Has produced more ballast, road metal, and broken more ore than all other Breake s combined.
Builders of High Grade Mining Machinery. Send for Catalogues.
GATES IRON WORKS,
50 C So. Clinton St., Chicago
136 C, Liberty Street, New York,
237 C, Franklin St., Boston, Mass

ARTESIAN
Wells, Oil and Gas Wells, drilled by contract to any depth, from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 1,000 feet. Write us stating exactly what is required and send for illustrated catalogue. Address
PIERCE ARTESIAN & OIL WELL SUPPLY CO.,
80 BEAVER STREET, NEW YORK.

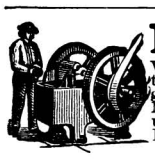


Pneumatic Tire Bicycles.
Every One Guaranteed.
Send for Catalogue.
☞ Agents Wanted.
KIRKWOOD, MILLER & CO.
16 South St., Peoria, Ill.

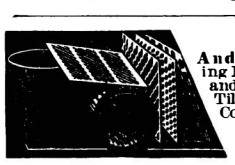
CLARK'S
WOOL WASHERS,
WARP DYEING AND SIZING MACHINES,
PATENT RUBBER COVERED SQUEEZE ROLLS,
POWER WRINGERS FOR HOSIERY AND YARN DYEING,
DRYING AND VENTILATING FANS,
WOOL AND COTTON DRYERS, Etc.
Catalogues free.
GEO. P. CLARK
Box L. Windsor Locks, Conn.



DO YOU USE GRINDSTONES?
If so, we can supply you. All sizes **mounted** and **unmounted**, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. ☞ *Ask for catalogue.*
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.



ROCK BREAKERS AND ORE CRUSHERS
We manufacture and supply at short notice and lowest rates, Stone and Ore Crushers, containing the invention described in Letters Patent issued to Eli W. Blake, June 15, 1858, together with NEW AND VALUABLE IMPROVEMENTS, for which Letters Patent were granted May 11 and July 20, 1880, to Mr. S. L. Marsden. All Crushers supplied by us are constructed under these patents.
FARREL FOUNDRY & MACHINE CO., Manufacturers, ANSONIA, CONN.
COPELAND & BACON, Agents, NEW YORK and CHICAGO.



STEEL, IRON, COPPER, ZINC, BRASS, TIN,
And all other Metals Perforated as Required for Grain Cleaning and Mining Machinery, Woolen, Cotton, Paper and Pulp Mills, Rice, Flour and Oil Mills, Sugar and Malt Houses, Distilleries, Filter Presses, Stone, Coal and Ore Screens, Brick and Tile Works, Filters, Spark Arresters, Gas and Water Works, Oil, Gas, and Vapor Stoves, Coffee Machinery, etc., etc. Standard Sizes Perforated Tin and Brass always in Stock.
THE HARRINGTON & KING PERFORATING CO., Chicago,
And 284 Pearl Street, New York.

BOOKS.

Our entirely new 116 page Catalogue of Scientific and Technical Books, both American and Foreign, just issued, containing a record of nearly 3,500 books, and embracing more than 300 different subjects, arranged under a new plan with cross references and author's index, will be mailed free to any address in the world on application. Address

MUNN & CO.,
Publishers "Scientific American,"
No. 361 BROADWAY, NEW YORK.

MAKING THE VINEYARD.—A VALUable article on the propagation and culture of the grape-vine. How to make cuttings, planting of cuttings, systems of training the vine, grafting by a simple side cleft, grafting by a simple transverse cut, cleft grafting with a scion that is to be rooted, saddle grafting. With 23 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **855** and **857**. Price 10 cents each. To be had at this office and from all newsdealers.

"ECONOMY IS WEALTH."
Canvassers wanted to sell the **New Model Hall Typewriter.** Why will people buy a $100 machine when $30 will purchase a better one? Send for illustrated catalogue and terms to County Agents.
Address N. TYPEWRITER CO.
611 Washington Street, Boston, Mass.
Mention Scientific American.

ALANSON CARY
MANUFACTURER OF **STEEL SPRINGS** OF EVERY DESCRIPTION
240 & 242 W. 29TH ST. NEW-YORK

Watchman's Improved Time Detector with 12 or 24 Keys, with Safety Lock attachment. Patented 1875-6-7. My inventions, and will sue all concerns selling or using the Safety Lock attachment, according to Decision of Circuit Court of U. S. for S. D. of N. Y.
Send for circulars to
E. IMHAUSER, 206 Broadway, New York. P. O. Box 2875.

SMOKELESS GUNPOWDER.—AN INteresting article by Hudson Maxim on the manufacture and use of smokeless gunpowder, giving a sketch of its history and the methods of producing it. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **821**. Price 10 cents. To be had at this office and from all newsdealers.

HOW TO MAKE A STORAGE BATtery.—By G. M. Hopkins. Directions for making a Planté battery and for charging the same. With 4 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **845**. Price 10 cents. To be had at this office and from all newsdealers.

FOOT LATHE
SCREW CUTTING
ADDRESS FOR **$40** CIRCULAR
NARRAGANSETT MAC. CO,
BOX 1008 PROVIDENCE, R.I.

NEW YORK TRADE SCHOOLS.—DEscription of the New York Trade Schools which were established nine years ago for the purpose of giving instructions to young men in certain trades, and to enable young men already in such trades to improve themselves. With 10 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **781**. Price 10 cents. To be had at this office and from all newsdealers.

A Great Advertising Medium.

The Architects and Builders Edition of the Scientific American.
(Established 1885.)

This superb architectural work has by far the largest circulation of any periodical of its class. It goes directly *into the hands of those who have the ordering of the great bulk of Building Materials and Appliances*, namely, the Architects, Builders, Constructing and Sanitary Engineers, Contractors, and House Owners.

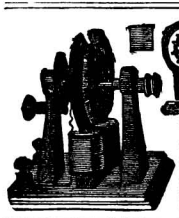
The Building Edition of the SCIENTIFIC AMERICAN is *unquestionably* the very best advertising medium for manufacturers and dealers in Building Materials, Carpenters' Tools, Woodworking Machinery, Heating, Ventilating, Plumbing and Sanitary Appliances, Roofing, Architectural Wood and Metal Work, Builders' Hardware, Doors, Sash, Blinds, Paints, and in fact all goods which enter into or are used in the construction and maintenance of Buildings or works of any kind.

The rates for advertising are moderate. For terms address MUNN & Co. Publishers, 361 Broadway, N. Y.

ARTISTS WHO GET RICH
often give good advice. Artists who use the Air Brush are getting rich, and recommend it very strongly. It is distinctively an art tool, and saves time and labor and increases the excellence of the work. Write for illustrated catalogue. It will interest you.
AIR BRUSH MFG. CO.
Rockford, Ill., U. S. A.
67 Nassau Street.

PROPOSALS.

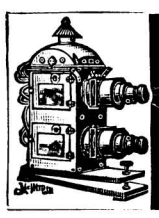
UNITED STATES ENGINEER OFFICE, NO. 73 Fourth Street, Portland, Oregon, September 15, 1892. —Sealed proposals, in duplicate, will be received at this office until 2 o'clock p. m., standard time, November 15, 1892, and then publicly opened, for furnishing all the material and labor necessary to complete the present project for improving canal at the cascades of the Columbia River, Oregon. Preference will be given to materials of domestic production or manufacture, conditions of quality and price (import duties included) being equal. Attention is invited to Acts of Congress, approved February 26, 1885, and February 23, 1887, vol. 23, page 332, and vol. 23, page 414, Statutes at Large. The Government reserves the right to reject any and all proposals, also to waive any informalities. Specifications, blank forms, and all available information will be furnished on application to this office. Persons intending to submit proposals must visit the locality of the works. THOS. H. HANDBURY, Major, Corps of Engineers, U. S. A.



Small Electric Motor
for Amateurs. Illus. in *Sci. Am. Supp.*, 783. Materials and directions for making sent by mail, $1.25. Difficult parts finished. Any one can make it. W. S. BISHOP, Mfr. of Electric Machinery, 958 Grand Ave., New Haven, Conn.

RAILWAY & STEAM FITTERS SUPPLIES
Rue's Little Giant Injector.
SCREW JACKS, STURTEVANT BLOWERS, &c.
JOHN S. URQUHART, 46 Cortlandt St., N. Y.

—FOR—
FREE SITES TO SUBSTANTIAL MANUFACTURING ENTERPRISES
in the rapidly growing towns of Virginia and West Virginia, possessing CHEAP IRON, CHEAP LUMBER, CHEAP FUEL, and RAILROAD FACILITIES, address J. H. DINGEE, 333 Walnut Street, Philadelphia, Pa., President and General Manager of numerous Land Companies situated along the lines of the Norfolk & Western Railroad.

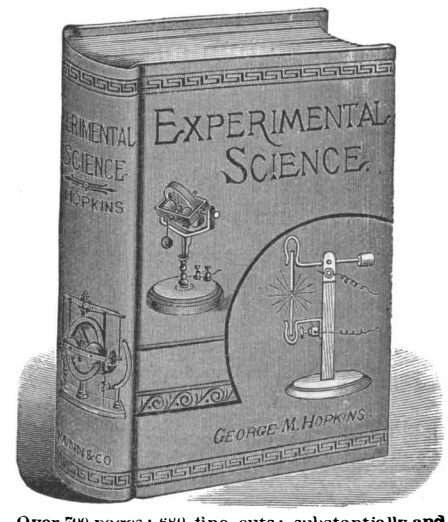


Steam! Steam!
Complete Fixtures except Stack.
2-Horse Eureka Boiler and Engine, - $175
4- " " " " " - - 275
Other sizes at low prices. Before you buy get our prices.
B. W. PAYNE & SONS,
Drawer 56. ELMIRA, N. Y.

WATER WHEELS JAMES LEFFEL & CO., SPRINGFIELD, OHIO, U.S.A.
Send for our fine large PAMPHLET.

HAVE YOU READ
Experimental Science?

This new book, by Geo. M. Hopkins, is just what you need to give you a good general knowledge of Physical Science. No one having the spirit of the times can afford to be without the kind of scientific information contained in this book. It is not only instructive, but entertaining.



Over 700 pages; 680 fine cuts; substantially and beautifully bound. Price by mail, **$4.00.**

☞ *Send for illustrated circular.*
MUNN & CO., Publishers,
Office of the SCIENTIFIC AMERICAN
361 BROADWAY, NEW YORK.

WORKING MODELS & LIGHT MACHINERY. INVENTIONS DEVELOPED. Send for Model Circular. Jones Bros. E Co., Cin'ti. O.

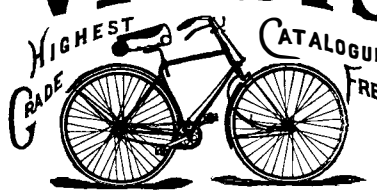
© 1892 SCIENTIFIC AMERICAN, INC.

Advertisements.

Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line

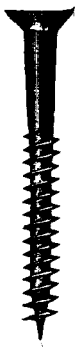
The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

Victors



OVERMAN WHEEL CO.
BOSTON. WASHINGTON. DENVER. SAN FRANCISCO.
A. G. SPALDING & BROS., Special Agents,
CHICAGO. NEW YORK. PHILADELPHIA.

"Spur Pointed" Wood Screws.



Patented May 10, July 19, 1887; Oct. 29, 1889; Aug. 19, Oct. 21, 1890; April 7, May 12, 1891; July 19, 1892.

Its Advantages are:
1. Stronger than a common screw.
2. Uniform and wide slot.
3. Requires the use of but one bit in hard wood.
4. Inserted easier.
5. Centralized point.
6. Superior holding power.
7. The screw being Cold Forged, instead of Cut, leaves on its entire surface a metallic skin.

☞ Send for samples to

AMERICAN SCREW CO.
PROVIDENCE, R. I.

THE AMERICAN BELL TELEPHONE CO.
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

Obstinacy is becoming in a mule; but a man ought to reason. Consider that American brains and machinery having made a good thing, will better it. An example is the new, perfected *quick-winding* Waterbury watch.

Gold filled and coin-silver cases make it rich and elegant. It is stem-set, winds in a few seconds; a perfect timekeeper; and still a low-priced watch.

What more can you ask?

Your jeweler sells it and will tell you all about it. 8

WANTED—A responsible party to manufacture and introduce to the trade a patented Push Screwdriver, or will sell one-half interest to one who will put it on the market. It sells on sight. Address Jas. Hays, 119 Howard Street, Dayton, O.

TRENTON IRON Co
TRENTON N.J.
STEEL MUSIC WIRE
EQUAL TO THE BEST IMPORTED
NEW YORK
COOPER, HEWITT & CO.

THE BRIDGEPORT WOOD FINISHING CO.
—MANUFACTURERS OF—
WHEELER'S PATENT WOOD FILLER.
BREINIG'S LITHOGEN SILICATE PAINT.
ADAPTED TO ALL CLIMATES ESPECIALLY MARINE EXPOSURES.
GRANVILLE M. BREINIG, GENERAL AGENT & SUPT.
PRINCIPAL OFFICE, NEW MILFORD, CONN.
Branch Offices and Warehouses.—CHICAGO, 211 East Randolph Street. NEW YORK, 240 Pearl St.—ST. LOUIS, 521 St. Charles St.—BOSTON, 85 Oliver St.
PAMPHLET GIVING DIRECTIONS FOR FINISHING HARD WOOD FREE TO ANY ADDRESS.

KODAKS.

Regular, Junior, Folding, Daylight, Ordinary } 14 styles and sizes for the season of 1892, $6.00 to $65.00.

Latest improvements, registers for exposures; glass plate attachments; daylight loading, etc., etc. *Send for catalogue.*

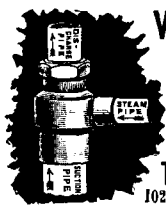
THE EASTMAN COMPANY,
ROCHESTER, N. Y.

"Improvement the order of the age."

THE SMITH PREMIER TYPEWRITER

Important Improvements.
All the Essential Features greatly perfected
The Most Durable in Alignment.
Easiest Running and Most Silent.
All type cleaned in 10 seconds without soiling the hands
The Smith Premier Typewriter Co., Syracuse, N. Y., U. S. A.
☞ Send for Catalogue.

COMPTOMETER.
TRADE MARK
Figures all Examples. Key operated. Rapid. Accurate. Relieves mental strain.
Send for Circular. F. & T. MFG. Co., 52-56 Illinois St. Chicago.



VANDUZEN STEAM JET PUMP
THE BEST IN THE WORLD.
Pumps Any Kind of Liquid.
Always in Order, never Clogs nor freezes. Every Pump Guaranteed.
—10 SIZES.—
200 to 12000 Gallons per Hour.
Cost $7 to $75 each. Address
THE VANDUZEN & TIFT CO.,
102 to 108 E. Second St., Cincinnati, O.

MAGIC LANTERNS
And STEREOPTICONS, all prices. Views illustrating every subject for PUBLIC EXHIBITIONS, etc.
☞ *A profitable business for a man with a small capital.* Also Lanterns for Home Amusements. 236 page Catalogue *free.*
McALLISTER, Mfg. Optician, 49 Nassau St., N.Y.

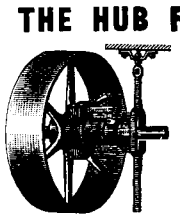
THE Motor of 19th Century
¾ to 50 H. P.
Can be used *Any Place*, to do *Any Work*, and by *Any One*. No Boiler! No Fire! No Steam! No Ashes! No Gauges! No Engineer! A perfectly safe Motor for all places and purposes. *Cost of operation about one cent an hour to each indicated horse power.*
Economy, Reliability, Simplicity, Safety.
For circulars, etc., address
CHARTER GAS ENGINE CO.
P. O. Box 148, Sterling, Ill.

WASHBURN
Guitars, Mandolins & Zithers in volume and quality of tone are the BEST IN THE WORLD. Warranted to wear in any climate. Sold by all leading dealers. Beautifully illustrated souvenir catalogue with portraits of famous artists will be Mailed FREE.
LYON & HEALY, CHICAGO.

VULCABESTON

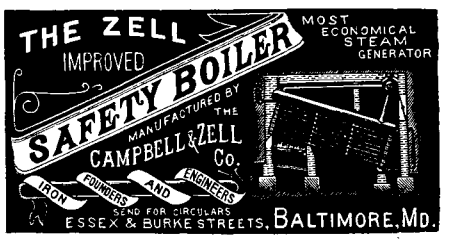
Composed of Asbestos, combined with Water and Acid Proof Materials, Compressed and Vulcanized FOR ELECTRICAL PURPOSES.
Switch Boards, Armature Sleeves, Battery Cells, Insulating Washers, Insulating Parts for Arc Lights, Incandescent Lights, Motors, Chandeliers, Dynamos, etc. Special styles and shapes to order. Prices on application.
H. W. JOHNS MANUFACTURING COMPANY,
SOLE MANUFACTURERS OF
H. W. Johns' Asbestos Millboard, Sheathings, Building Felts, Fire-Proof Paints, Liquid Paints, Asbestos Roofing, Etc.
87 MAIDEN LANE, NEW YORK. CHICAGO, PHILADELPHIA, LONDON.

THE HUB FRICTION CLUTCH,



applied to Pulleys, Gears, Sprocket Wheels, Reversible Countershafts and Cut-off Couplings. The most simple, effective, durable and economical Clutch on the market. Made in sizes to transmit from 2 up to 1000 h. p., at slow or fast speed. Over 10,000 in use. Write for cuts, description, price list and discounts, to the makers,
The James Smith Woolen Machinery Co.,
411-421 Race St., Phila., Pa.

$22. FIRST CLASS CURTAIN DESK Four and a Half feet long. Unlimited variety in stock and to order.
American Desk & Seating Co.
270-272 Wabash Av., CHICAGO, U.S.A.



PATENTS!

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty-five years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing Patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

SAWS Wanted 50,000 Sawyers and Lumbermen to send us their full address for a copy of Emerson's ☞ Book of SAWS, new 1892 edition. We are first to introduce NATURAL GAS for heating and tempering Saws with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address EMERSON, SMITH & CO. (Limited), Beaver Falls, Pa. SAWS SAWS

LIFE OF AN ANT.—BY E. A. BUTler. An entertaining paper on the life of an ant from the egg to the mature state. With an account of the curious habits of these insects. With 4 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 857. Price 10 cents. To be had at this office and from all newsdealers.

THE ARMSTRONG MACHINES,
For Cutting Off and Threading Pipe.

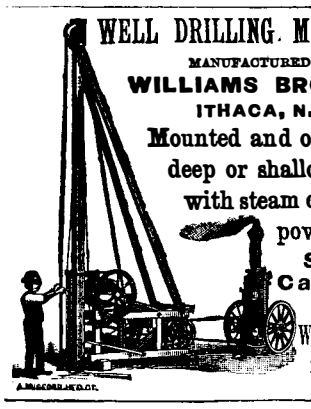
For Hand or Power.
No. 1 cuts off and threads 1 to 3 inch.
No. 2 cuts off and threads 1 to 4 inch.
No. 3 cuts off and threads 1 to 6 inch.
Our aim is to make these machines as good as our Stocks and Dies, which are universally acknowledged to be THE BEST. ☞ Send for catalogue.
THE ARMSTRONG MFG. CO., Bridgeport, Ct.

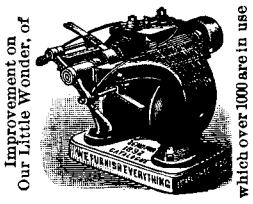
Edison General Electric Company
THE EDISON SYSTEMS OF
Incandescent Lighting, Street Railways and Transmission of Power
—ARE THE—
SAFEST—MOST RELIABLE—BEST.
OUR ELECTRIC LAMP SIGNS ARE A GREAT COMMERCIAL INNOVATION.
BRANCH OFFICES:

620 Atlantic Avenue.....Boston, Mass.	44 Broad Street.....New York.
173 and 175 Adams Street.....Chicago, Ill.	509 Arch Street.....Philadelphia, Pa.
264 West Fourth Street.....Cincinnati, O.	401-407 Sibley Street.....St. Paul, Minn.
Gould Building.....Atlanta, Ga.	Masonic Temple.....Denver, Colo.
15 First Street.....San Francisco, Cal.	

THE GRAVES PASSENGER & FREIGHT ELEVATORS.
L. S. GRAVES & SON ROCHESTER N.Y. NEW YORK. BOSTON. ST LOUIS. DETROIT.

WELL DRILLING MACHINERY,
MANUFACTURED BY
WILLIAMS BROTHERS,
ITHACA, N. Y.,
Mounted and on Sills, for deep or shallow wells, with steam or horse power.
Send for Catalogue.
ADDRESS
Williams Brothers
ITHACA, N. Y.





Improvement on Our Little Wonder, of which over 1000 are in use

NICKEL AND ELECTRO-PLATING
Apparatus and Material.
THE Hanson & Van Winkle Co.
Newark, N. J.
81 LIBERTY ST., N. Y.
23 S. CANAL STREET, CHICAGO.

THE
SCIENTIFIC AMERICAN
ESTABLISHED 1846.
The Most Popular Scientific Paper in the World
Only $3.00 a Year, Including Postage.
Weekly—52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of three dollars by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to
MUNN & CO., 361 Broadway, New York.

THE
Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,
MUNN & CO., 361 Broadway, New York.

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern architectural construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the Largest Circulation of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to
MUNN & CO., Publishers,
361 Broadway, New York.

PRINTING INKS
The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York

© 1892 SCIENTIFIC AMERICAN, INC.